Mathematics
Grade 6

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Send your comments and suggestions to:
Curriculum Development Centre
Phone: 01-6630588
Email: cdc@ntc.net.np
Website: moecdc.gov.np

Preface

School education is the foundation for preparing the citizen who are loyal to the nation and nationality, committed to the norms and values of federal democratic republic, self-reliant and respecting the social and cultural diversity. It is also remarkable for developing a good moral character with the practical know-how of the use of ICT along with the application of scientific concept and positive thinking. It is also expected to prepare the citizens who are moral and ethical, disciplined, social and human value sensitive with the consciousness about the environmental conversation and sustainable development. Moreover, it should be helpful for developing the skills for solving the real life problems. This textbook 'Mathematics, Grade 6' is fully aligned with the intent carried out by the National Curriculum Framework for School Education, 2076 and is developed fully in accordance with the new Basic Level Mathematics Curriculum (Grade 6-8), 2077.

This textbook initially written by Ms. Anupama Sharma, Dr. Ekraj Pandit and Mr. Narahari Acharya. This book has been translated by Mr. Raj Kumar Mathema, Mr. Krishna Bahadur Bista and Mr. Anil Kumar Jha. The contribution made by Director General Ana Prasad Neupane, Prof. Dr. Ramji Prasad Pandit, Ms. Pramila Bakhati, Mr. Ram Hada, Ms. Nirmala Gautam, Mr. Keshavraj Phulara, Mr. Jagannath Adhikari and Mr. Ram Chandra Dhakal is remarkable in bringing the book in this form. The language of this book was edited by Mr. Shankar Adhikari. The illustrations in the book are done by Dev Koimee and the layout was designed by Mr. Khados Sunuwar. The Curriculum Development Centre extends sincere gratitude to all of them.

The textbook is a primary resource for classroom teaching. Considerable efforts have been made to make the book helpful in achieving the expected competencies of the curriculum. Curriculum Development Centre always welcomes constructive feedback for further betterment of its publications.

2078 B.S.

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Sanothimi, Bhaktapur

Content

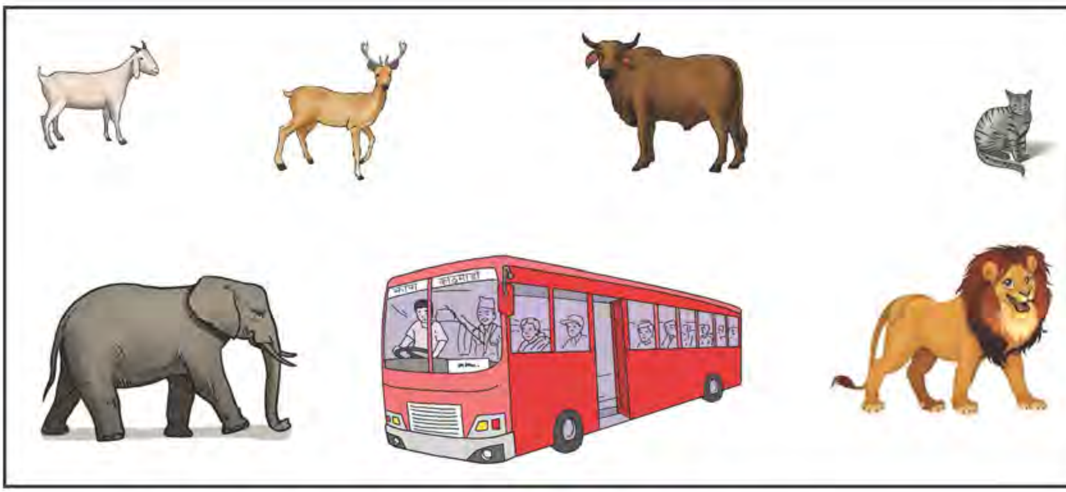
Unit One | Set

Lesson 1

Set

1.0 Review

Observe the poster given below and draw the conclusion by discussing on the following questions:



(a) What kinds of things are in the above poster?

(b) Differentiate the things on the basis of their characteristics.

(c) After differentiating the things, what do you call for the remaining things?

It is difficult to specify the collection of above things. But we can say that it is the collection of animals if we replace the picture of the bus from the group. It can be called the set of animals in the poster.

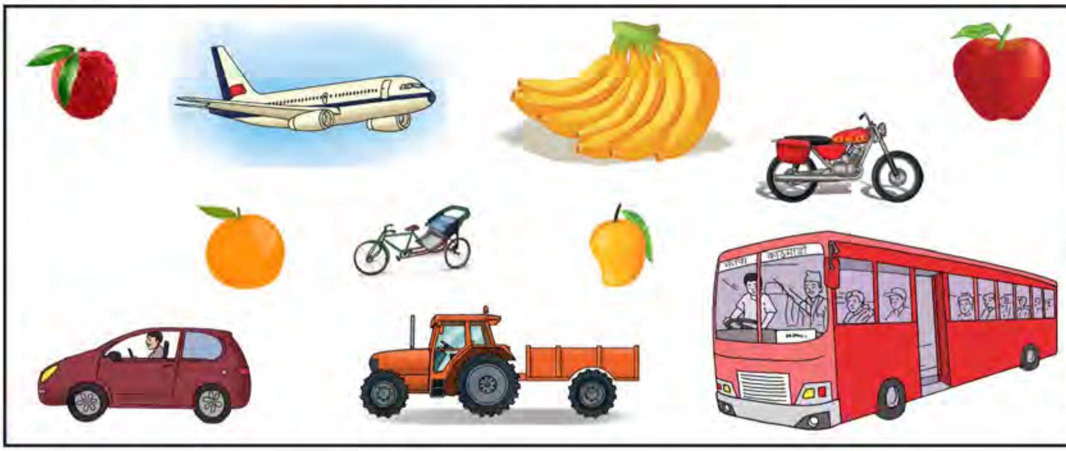
When A denotes to a set of animals,

A = {elephant, lion, goat, deer, cat, ox} can be written.

- A set is a well-defined collection of objects. It can be said with certainty whether an object belongs to the set or not.
- The set is represented by the capital letters A, B, C, … of the English alphabet. The members of the set are represented by the small letters a, b, c, …

Activity 1:

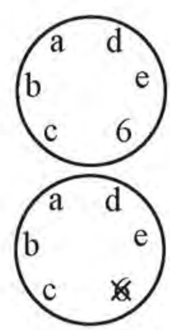
How many different sets can be formed from the collection of different objects given in the figure on the basis of the same type or similar properties? Discuss in pairs and present to the class.



Example 1:

Write the name of set by crossing (×) the odd one.

Solution:



Here, a, b, c, d, e are the first five letters of the English alphabet. 6 is a natural number. Removing 6 from this circle forms a set of the first five letters of the English alphabet.

Example 2:

Write whether the following given collections are defined collections or not:

(a) Odd natural numbers less than 20

(b) Two beautiful cities of Nepal

(c) Tall students in class 6

(d) Name of days of a week starting with English letter S

Solution:

(a) "The collection of odd natural numbers less than 20" can be said with certainty, so it is well defined.

(b) It is not certain on what basis to select two cities in Nepal, so it is not well defined.

(c) It is not certain how tall students can be placed in a set of tall students in class 6, so it is not well defined.

(d) The names of the days of the week beginning with the English letter S can be said to be Sunday and Saturday, so it is a well defined.

Exercise 1.1

1. Observe the set of collections and discuss what it is?

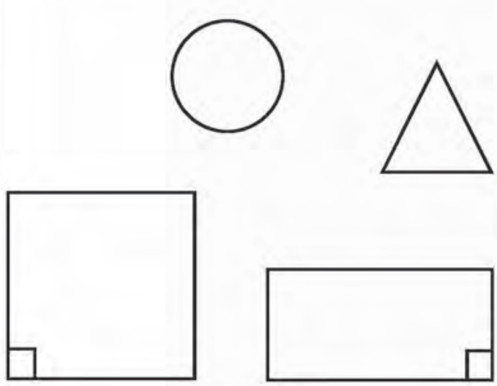
(a) Sunday, Monday, Tuesday, Wednesday, Thursday, Friday, Saturday

(b) 2,3,5,7

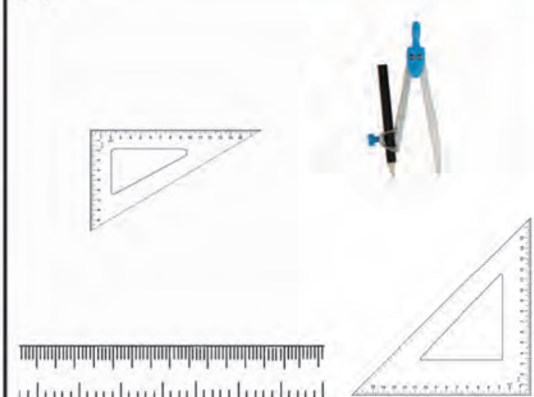
(c) a, e, i, o, u

2. Observe the the following collection of items. Then, discuss and write the name of sets.

(a)



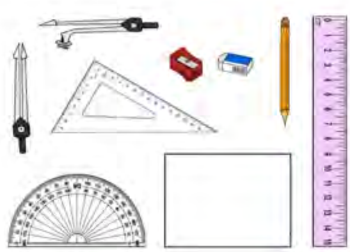
(b)

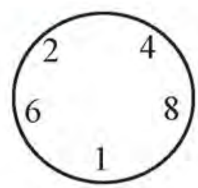


(c)

(d)

3. **Cross (×) the odd one and write the name of set.**





4. **Write down with reasons either the following collections are set or not.**

   (a) A collection of 6^{th} grade students who write good letters.

   (b) A collection of students who sing well.

   (c) A collection of teachers who teach in 6^{th} grade in your school.

   (d) A collection of 6^{th} grade textbooks.

   (e) A collection of factors of 30.

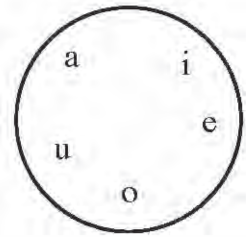
Answer

Show all the answer to the teacher.

1.1 Method of describing set:

Activity 1

What is there inside the circle in the picture? How do we write in set after finding the common property of given sets? Discuss it.



There are the vowel letters of the English alphabet within a circle in the figure. So it can be called a set of vowel letters of the English alphabet. When the above set is denoted by V, V = {a,e,i,o,u} can be written.

Thus, the method of listing the members of the set in a middle bracket separated by commas is a listing method. Is there another method to denote a set in the same way?

Methods of describing set:

(a) **Listing method:** The method in which the members of the set are written within the middle brackets separated by commas is called listing method. For example: V = {a, e, i, o, u}

(b) **Describing method:** The expression of words or sentence considering the qualities of the members of a set is called describing method. For example: V = {Vowels sound of the English alphabet}

(c) **Set builder method:** In this method, it defines the variables based on the common properties of the members of a set. For example: V = {x: x is a prime number less than 10.} Here, x is a variable. x is placed in place of a prime number less than 10. So, x represents 2, 3, 5, 7. Sign ':' indicates such that.

Example 1

Write the set of factors of 16 using the listing method in the symbol of set.

Solution :

Let the factors of 16 are denoted by F_{16}, then

$F_{16} = \{1, 2, 4, 8, 16\}$

Steps

(a) Decide the letter to represent the set.
(b) Identify all members of the set.
(c) Write the members within the curly bracket { } separated by commas.
(d) Write all the members without repeating.

Example 2

Write the given set {0, 2, 4, 6, 8, 10} in describing method:

Solution:

Here, when the given set is denoted by A:

A = {0, 2, 4, 6, 8, 10}

While we write in the describing method:

A = {set of even number up to 10}

Steps:

(a) Decide a letter to represent the set.
(b) Identify the common properties of all the members of the set.
(c) Consider the properties of the set and write in sentences.

Example 3

Write the given set using the set builder method. A = {1, 2, 3, 4, 5}

Solution:

Here, A ={ x:x is a natural number less than 6.}

Exercise 1.2

1. **Write each of the following set in listing method:**
   (a) Set of 12 months of Nepali calendar.
   (b) Set of colours used in the national flag of Nepal.
   (c) Set of whole numbers less than 10.
   (d) Set of prime numbers less than 10.

2. **Write each of the following set in describing method:**

(a) A = {2,4,6,8,9}

(b) B = {1,3,5,7,9}

(c) C = {3,6, 9, 12, 15)

(d) D = {1, 3,9}

3. **Write each of the following set in set builder method:**

(a) A = {2, 4, 6, 8, 10}

(b) B = {1,4,9}

(c) C = set of composite numbers up to 20

(d) T = {right-angled triangle, acute-angled triangle, obtuse-angled triangle}

4. **Write the following set in the listing method and also write the number of members of those set:**

(a) A = {set of prime numbers of 15}

(b) B = {x: x is a set of multiples of 4 up to 40.}

(c) C = {a set of counting numbers greater than 2 and smaller than 7)

(d) D = {a set of factors of 20}

Project work:

Collect the objects of your classroom. Create at least 3 well defined sets of objects that have the same properties from the these objects. Then, present it in the classroom in describing method, listing method and set builder method.

Answer:

Show all answers to the teacher.

1.2 Membership of a set

Activity-1

What do you see inside the circle?

(a) Is the Marigold flower a member of this set?

(b) Discuss whether the velvet flower is a member of this set or not.

In the given figure, there are different flowers in the circle. It is a collection of rose, marigold, sunflower and lotus flowers. All the flowers in the circle are members of this set. If this set is denoted by F, then F = {rose, marigold, sunflower, lotus} can be written. The set has four members. Marigold flower belongs to set F. So, the Marigold $\in$ F is written. Velvet flower is not in set F. Velvet flower is not a member of this set. So, velvet $\notin$ F is written.

Symbol $\in$ indicates a member or belongs to the set. The symbol '$\in$' is read as belongs to. Symbol $\notin$ indicates that is not a member or do not belong to the set. The symbol $\notin$ is read as does not belong to.

Example 1

1. **Write in the blank space after selecting the matching symbol $\in$ or $\notin$**

   (a) 6 .... {1, 2, 3, 4, 5, 6, 7, 8, 9, 10} (b) 5 .... {2, 4, 6, 8, 9}

Solution:

(a) 6 belong to the set {1, 2, 3, 4, 5, 6, 7, 8, 9,10}. It is written as 6 $\in$ {1, 2, 3, 4, 5, 6, 7, 8, 9,10}. So, 6 is a member of this set.

(b) 5 is not in set {2,4,6,8,9). It is written as 5 $\notin$ {2, 4, 6, 8, 9}. So, 5 is not a member of this set.

Exercise 1.3

1. **Write in the blank space by choosing a matching symbol $\in$ or $\notin$:**
   (a) 1….. {set of factors of 6}
   (b) △ ……. {□, ⊙, △}
   (c) 9…… {set of multiples of 3}
   (d) 9……{set of prime numbers smaller than15}
2. **Write (T) for correct and (F) for incorrect. If S represents a set of SAARC nations,**
   (a) Nepal $\in$ S
   (b) Thailand $\notin$ S
   (c) India $\in$ S
   (d) Bangladesh $\notin$ S.
3. **Write the following given set in set symbol by listing method:**
   (a) Set of letters in the word kathmandu
   (b) Set of letters in the word mathematics
   (c) Set of members in both sets (a) and (b)

Answer:

Show all the answers to the teacher.

Mixed exercise:

1. **If set A={set of factors of 6} and set B = {set of prime numbers less than10}, write the set A and set B in the listing and set builder method.**
2. **Write a set of composite numbers less than 10 in the describing method.**
3. **If set A={set of even numbers less than 10} and set B = {set of odd numbers less than10}, write the set A and set B by the listing and set builder method.**

Unit-two | Arithmetic

Lesson 2

Whole Number

2.0 Review

Observe the following figures, discuss with friends and find out the conclusion.

(a) How many pencils are in Figure I?

(b) How many grains of rice are in a bag of rice shown in Figure II?

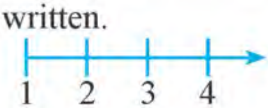
(c) Is it possible to count pencils, rice grains?

Figure I

Figure II

The pencils can be counted. The grains of rice in the bag can be counted but it is difficult to count all. Thus the number which is used to calculate objects is called a natural number, such as: 1, 2, 3, … The natural number goes from 1 to infinity. The set of natural numbers is denoted by N.

N = {1, 2, 3, 4, …} is written.



The set of counting numbers is called the natural number.

2.1 Introduction to whole numbers

Activity-1

Discuss the following questions with your friends and find out the conclusion:

(a) Is the sum of two natural numbers also a natural number?

(b) Is the product of two natural numbers also a natural number?

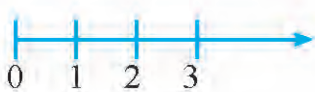
(c) What is the difference between two natural numbers?

Sum or product of any two natural numbers are also natural number. But the difference between any two natural numbers may not be a natural number, such as:

$8 + 6 = 14$	$8 + 8 = 16$
$8 \times 6 = 48$	$8 \times 8 = 64$
$8 - 6 = 2$	$8 - 8 = 0$

Here, zero 0 is not a natural number. Zero is used to indicate the number of objects that no matter how many. The whole number starts from zero and goes to infinity. The set of whole number is denoted by W.

So W = {0, 1, 2, 3, 4, ...}



A set of natural numbers with zero is called a whole number. The first and smallest whole number is zero "0".

2.1.1 Smallest and largest numbers

Activity 1

Complete the table given below and write the smallest and largest numbers formed by different digits:

	Smallest number	Largest number
made up of 1 digit	1	9
made up of 2 digits	10	99
made up of 3 digits		
made up of 4 digits		
made up of 5 digits		
made up of 6 digits		

Any numbers can be formed by using ten digits 0, 1, 2, 3, 4, 5, 6, 7, 8 and 9.

Activity 2

I : Take number cards written three-digits. $\boxed{1}$ $\boxed{5}$ $\boxed{8}$

II : Write as many numbers as you can by using these three number cards.

III : Now, present the numbers you have written in the classroom.

IV : State the smallest number and the largest number among these numbers.

Putting $\boxed{1}$ of cards in place of hundred makes 185 and 158. Putting $\boxed{8}$ in place of hundred makes 815 and 851. Similarly, putting $\boxed{5}$ in place of hundred makes 518 and 581. In this way, a total of 6 numbers are formed. Among these numbers, the largest number is 851 and the smallest number is 158.

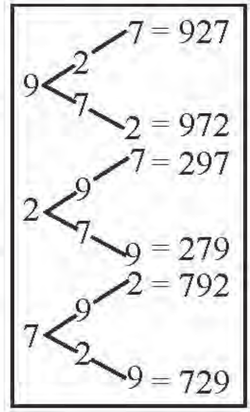
Since the value of the digits in any number varies from depending on their place, its position can be changed to make a larger or smaller number. Numbers can be formed bigger or smaller depending on the place value of the digits.

Example 1

Write the possible numbers that can be formed from 9,2 and 7.

Solution:

Numbers formed from 9, 2 and 7 are shown in the figure on the right:



Possible numbers:

927, 972, 297, 279, 792,729

Example 2

Find the difference between the largest and the smallest numbers of three digits formed by 5, 0 and 1.

Solution:

Here, the largest number of three digits formed from 5, 0 and 1 is 510 and the smallest number is 105.

The difference between them = 510 – 105 = 405

Exercise 2.1

1. **Write the sign (√) if the following statement are true and the sign (×) if the statements are false:**
   (a) Any number can be written by using ten digits from 0 to 9.
   (b) The smallest natural number is zero (0).
   (c) The first and smallest whole number is zero (0).
   (d) The natural number starts from 1 and goes to infinity.
   (e) The smallest number formed from 2, 1 and 0 is 102.
2. **Write a three-digit numbers formed from 2, 1 and 7.**
3. **Write the largest and smallest numbers of the three digits formed from 7, 9 and 0. Also find their sum and difference.**

4. **Write the largest and smallest numbers of the four digits. Also, find their sum and difference.**
5. **Write the largest number of three digits formed from three different digits. Write it.**
6. **Write the smallest number of three digits formed from three different digits. Write it.**
7. **(a) Make a list of five-digit numbers made up of 0, 1, 4, 6 and 7.**
   (b) Write the numbers in ascending and descending orders.
   (c) Find the sum and difference of the largest and the smallest number.

Project work:

Write the uses of whole number in our daily lives? You can ask your elders or by searching in the internet and present it in the classroom.

Answer:

Show it to the teacher.

2.2 Simplification

Activities-1

Krishna distributed 20 pencils to his 10 friends equally. One of his friend Ram received 4 pencils from his mother too. After that he gave 5 pencils to his sister. How many pencils has left with him.

Krishna has number of pencils = 20

Divided among 10 friends, Ram has got = $20 \div 10 = 2$ pencils

Number of pencils given by Ram's mother = 4

Now, the total pencil with Ram = 2 + 4 = 6

After Ram gave 5 pencils to his sister,

the remaining pencil with him = 6 - 5 = 1

The above problem can be solved by writing it in mathematical sentences.

$20 \div 10 + 4 - 5$

$= 2 + 4 - 5$

$= 6 - 5$

$= 1$

Example 1

Out of 20 rubber bands that Goma had, she gave 18 rubber bands to her friend Geeta. If Goma's mother added 16 rubber bands to Goma, how many rubber bands does Goma have now?

Solution:

Writing in mathematical sentences:

$20 - 18 + 16$

$= 20 - 18 + 16$

$= 2 + 16$

$= 18$

Example 2

Subtract 12 from three times of 18 and add 20.

Solution:

Writing in mathematical sentences, $18 \times 3 - 12 + 20$

$= 54 - 12 + 20$

$= 42 + 20$

$= 62$

2.2.1 Simplification with brackets

Activity 2

Study the mathematical problems given below and discuss the following questions:

Out of 12 chocolates that Sajan had, he kept 4 of them himself and distributed the remaining chocolates equally to 2 friends. How many chocolates did one friend get?

(a) What mathematical operations are needed to solve this problem?

(b) How can it be written in mathematical sentences?

(c) How can this problem be simplified?

Number of chocolates owned by Sajan = 12

Numbers of chocolates kept by himself = 4

Number of chocolates distributed by Sajan to friends = 12 – 4 = 8

Dividing 8 chocolates into two equal parts = 8 ÷ 2 = 4

When writing the above problem in mathematical sentences,

$(12 - 4) \div 2$

$= 8 \div 2$

$= 4$ $\quad\therefore$ A friend got 4 chocolates.

Example 1

There are 10 bags of 8 oranges each. All those oranges are divided equally to 5 persons. How many oranges does one person get by adding 2 more oranges?

Solution:

$\{(8 \times 10) \div 5\} + 2$

$= \{80 \div 5\} + 2$

$= 16 + 2$

$= 18$ $\quad\therefore$ One gets 18 oranges.

Activity 3

How can the given mathematical problem be solved? Draw the conclusion discussing the following questions.

Simplify: $\{(45-3) \div 6\} + 8$

(a) Can we divide by 6 without subtracting 3 from 45 while simplifying $\{(45-3)\div 6\} + 8$?

(b) Which work should be done at first with the brackets?

(c) What is the order of the brackets when simplifying?

Here, it should be divided by 6 only after subtracting 3 from 45 and added 8 at the end. So, (45-3) is placed in the small bracket and $\{(45-3)\div 6\}$ is placed in the curly bracket.

Solution:

$$\{(45 - 3) \div 6\} + 8$$
$$= \{42 \div 6\} + 8$$
$$= 7 + 8$$
$$= 15$$

> While simplifying the problems containing four fundamental operation (+, -, ×, ÷) and brackets, we should do the work of operation within the bracket at first and then do the rest operations. The brackets used in the simplification should be followed by operations containing the small bracket ( ), curly bracket { } and big bracket [ ].

Example 1

Pawan had 1750 rupees. Pratima had 450 rupees less than Pawan. If Pratima gave one-fourth of the money which she had to her brother, how much money does she give to her brother? Find it.

Solution:

The amount with Pawan = Rs.1750

The amount with Pratima = Rs.1750 - Rs.450

= Rs.1300

Now, the amount given by Pratima to the brother = Rs.1300÷ 4

= Rs.325

When writing the above problem in mathematical sentence,

$= (1750 - 450) \div 4$

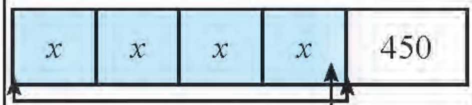
$= 1300 \div 4$

$= 325$

The amount given to her brother by Pratima = Rs.325

From the model drawing method

The amount with Pawan = Rs. 1750



The amount with Pratima

The amount given to Pratima's brother

$4x + 450 = 1750$

or, $4x = 1750 - 450$

or, $4x = 1300$

or, $x = \frac{1300}{4} = 325$

Example 2

Simplify: [20 × {40 - 6× (7-2)}] + 16

Solution:

Here, [20 ×{40-6× (7-2)}] + 16

= [20 × {40-6×5}] + 16	doing the operation within bracket ( )
= [20× {40-30}] + 16	doing the operation within bracket { }
= [20 × 10] + 16	doing the operation within bracket { }
= 200 + 16	doing the operation within bracket [ ]
= 216	

Example 3:

Simplify: 128 ÷[4+ {12×(5-4)}] + 6

Solution:

Here, 128 ÷[4+ {12×(5-4)}] + 6

= 128÷ [4+ {12× 1}] +6	doing the operation within bracket ( )
= 128 ÷ [4+ 12] + 6	doing the operation within bracket { }
= 128 ÷16 + 6	doing the operation within bracket [ ]
= 8 + 6	Dividing
= 14	Adding

Exercise 2.2

1. **Simplify:**

(a) $20 + 5\times3$

(b) $400 - (50\times2)$

(c) $80+ (20 \div 4)$

(d) $25- (8\div4)$

(e) $50 \times (4 \div 2)$

(f) $44- \{4+ (5-2)\}$

(g) $16-8 \{17- (45 \div 3)\}$

(h) $\{(5 + 4) \times3-7\} \div2$

(i) $17- [\{25 \div5 + 3\times4- (6 + 5)\}]$

(j) $33\div \{3+ (7-1) +2\}$

2. **Write the following practical problems in mathematical sentences and simplify:**

(a) Sima bought a book for Rs.185 out of Rs.400 which she had. Then her maternity uncle gave her Rs.200, how much money does she have now?

(b) If Rachana gives a note of Rs.500 to the shopkeeper to buy 5 copies of Rs.45 each, how much money does she get back?

(c) Vidusa bought 4 packets of chocolates containing 25 pieces each and 20 pieces extra on the occasion of her birthday. If she distributes 30 of those chocolates to her family, how many chocolates does she have left now?

3. **Write the following statements in mathematical sentences and simplify:**

(a) What is the value when the sum of 182 and 8 is divided by the difference of 75 and 65?

(b) What is the value when 15 is subtracted from 5 times of 18 and divided by 5?

(c) What is the value when the difference between 25 and 9 is dividing by 8 and multiply by 4?

(d) What is the value when subtracting 17 from 3 times the sum of 7 and 4 is divided by 8?

Answer

1. (a) 35 (b) 300 (c) 85 (d) 23 (e) 100 (f) 37 (g) 0 (h) 10 (i) 11 (j) 3
2. (a) 415 (b) 275 (c) 90 (d) 0 (e) 12
3. (a) 19 (b) 15 (c) 8 (d) 2

2.3 Divisibility test

Does 3 divide 365 without a remainder? Discuss it. Dividing 365 by 3, the quotient is 121 and 2 is left as the remainder.

$$\begin{array}{r} 121 \\ 3\overline{)\,365} \\ -3 \\ \hline 6 \\ -6 \\ \hline 5 \\ -3 \\ \hline 2 \end{array}$$

Testing the number which is exactly divisible by a number without showing the process of division is called divisibility test.

Activity-1

1. **Write a multiplication table of 2:**

   $2 \times 1 = 2$

   $2 \times 2 = 4$

   $2 \times 3 = 6$

   $2 \times 4 = 8$

   $2 \times 5 = 10$

   ...

2. **What types of number are the numbers 2,4, 6, 8, 10… from the multiplication table of 2?**

3. **Are 2, 4, 6, 8, 10, ... exactly divisible by 2? Discuss and draw conclusions.**

   Here, 2.4, 6, 8, 10. … are all even numbers. So 2,4, 6, 8, 10, … are exactly divisible by 2.

All even numbers are exactly divisible by 2.

Activity-2

1. Take a number, such as: 2343
2. Divide that number by 3.

   2343 was exactly divided by 3.

3. **Now, find the sum of the digits in those numbers.**

The sum of the digits= $2 + 3 + 4 + 3 = 12$

$$\begin{array}{r} 781 \\ 3\overline{)2343} \\ -21 \\ \hline 24 \\ -24 \\ \hline 3 \\ -3 \\ \hline 0 \end{array}$$

4. **Is 12 exactly divisible by 3? Discuss it.**

Here, the sum of the digits of the number 2343 is 12. The sum 12 is exactly divisible by 3. So 2343 is also exactly divisible by 3.

If the sum of the digits in any number is exactly divisible by 3, then that number is also exactly divisible by 3.

Example 1

Test whether the number 12345 is exactly divisible by 3 or not.

Solution:

Here, the given number = 12345

The sum of the digits in the given number = $1 + 2 + 3 + 4 + 5 = 15$

15 is exactly divisible by 3. Therefore, 12345 is also exactly divisible by 3.

Now, divide 12345 by 3 yourself.

Activity 3

1. **Write a multiplication table of 5:**

$5\times1 = 5$

$5\times2 = 10$

$5\times3 = 15$

$5\times4 = 20$

$5\times5 = 25$

....

2. What are the digits in place of one of the numbers 5, 10, 15, 20, 25, … from the multiplication table of 5?

3. Whether 5, 10, 15, 20, 25, … are exactly divisible by 5 or not, discuss and draw conclusions. In 5, 10, 15, 20, 25, … etc., all the numbers have either 0 or 5 in place of one. So, 5, 10, 15, 20, 25, … all the numbers are exactly divisible by 5.

> If a number has a digit 0 or 5 in its unit place, then that number is exactly divisible by 5.

Example 2

Test whether the number 895 is exactly divisible by 5 or not.

Solution:

The given number = 895

Number 895 has 5 in place of one. So 895 is exactly divisible by 5.

Now, divide 895 by 5 yourself.

Activity 4

1. Take a number, such as: 651
2. Write twice the number in place of one of those numbers. In place of one there is 1. Twice of $1 = 1 \times 2 = 2$.
3. Now, after removing the digit in the place of one, subtract the number twice of the digit in the place of one from the remaining number.

   The number remaining after removing the digit in place of one = 65

   The difference between the remaining number and two times the number in place of one = $65 - 2 = 63$
4. Discuss whether the result after subtracting is divisible by 7 or not. 63 is exactly divisible by 7. So 651 is also exactly divisible by 7. Now, divide 651 by 7.

$$\begin{array}{r} 93 \\ 7\overline{)651} \\ -63\downarrow \\ \hline 21 \\ -21 \\ \hline 0 \end{array}$$

> If the difference of any number formed by removing the digit of unit place and twice the digit of unit place is exactly divisible by 7, then the given number is exactly divisible by 7.

Example 3

Test whether the number 252 is exactly divisible by 7 or not:

Solution:

252 has 2 in place of one whose two times, 4 is subtracted from the number 25 formed by the remaining digits, i.e. 25 - 4 = 21. 21 is exactly divisible by 7. So, 252 is also exactly divisible by 7.

Now, divide 252 by 7 yourself.

Activity 5

1. Take a number, such as: 2431
2. Take out the digit in the place of one from that number and write the number formed by the remaining digits. For example: taking 1 from 2431, then the number formed from the remaining digits is 243.
3. Now, subtract the digit of ones place from the number formed by remaining digits. 243 – 1 = 242
4. Repeat this process until the final result is a two digit number. So, taking 2 out from 242, then the number formed from the remaining digits is 24. Now, subtracting 2 from 24, 24-2 = 22.
5. Discuss whether the result is exactly divisible by 11 or not. Here, 22 is exactly divisible by 11. So 2431 is also exactly divisible by 11.

   Now, let's divide 2431 by 11:

$$\begin{array}{r} 221 \\ 11\overline{)2431} \\ -22 \\ \hline 23 \\ -22 \\ \hline 11 \\ -11 \\ \hline 0 \end{array}$$

> If the difference after subtracting the number formed by a digit in the place of one of any number from the number formed by the remaining digits of it is exactly divisible by 11, then that number is also exactly divisible by 11.

Example 4

Test whether the number 407 is exactly divisible by 11 or not:

Solution:

Subtracting 7 which is in one's place on the given number 407 from the number 40 formed from the remaining digits, 40 - 7 = 33

Here 33 is exactly divisible by 11. So 407 is divisible by 11. Now, let's divide 407 by 11.

Exercise 2.3

1. **Write the sign (√) for the correct statement and the sign (x) for the false statement given below:**
   (a) All the even numbers are exactly divisible by 2.
   (b) All odd numbers are exactly divisible by 3.
   (c) The sum of the digits of any number is exactly divisible by 3 then the number is also exactly divisible by 3.
   (d) 8590 is exactly divisible by 5.
   (e) The difference after subtracting the number formed by the digit in the place of one of any number from the number formed by the remaining digits exactly divisible by 7 then the given number is exactly divisible by 7.
2. **Which of the following given numbers are exactly divisible by 2? Write with divisibility test.**
   (a) 1644 (b) 113 (c) 843 (d) 1056
3. **Which of the following given numbers are exactly divisible by 3? Write with divisibility test.**
   (a) 111 (b) 7542 (c) 9437 (d) 1464
4. **Which of the following given numbers are exactly divisible by 5? Write with divisibility test.**
   (a) 1434 (b) 1250 (c) 1965 (d) 2100
5. **Which of the following given numbers are exactly divided by 7? Write with divisibility test.**
   (a) 1890 (b) 4095 (c) 2160 (d) 2430
6. **Which of the following given numbers are exactly divisible by 11? Write with divisibility test.**
   (a) 9240 (b) 16800 (c) 18480 (d) 13680

Answer

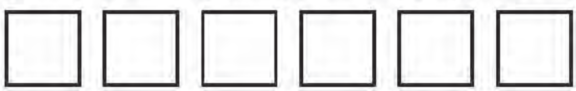
1. Show the teacher.
2. (a) 1644 (d) 1056
3. (a) 111 (b) 7542
4. (b) 1250 (c) 1965
5. (a) 1890 (b) 4095
6. (a) 9240 (c) 18480

2.4 Factors and multiples

2.4.1 Factors

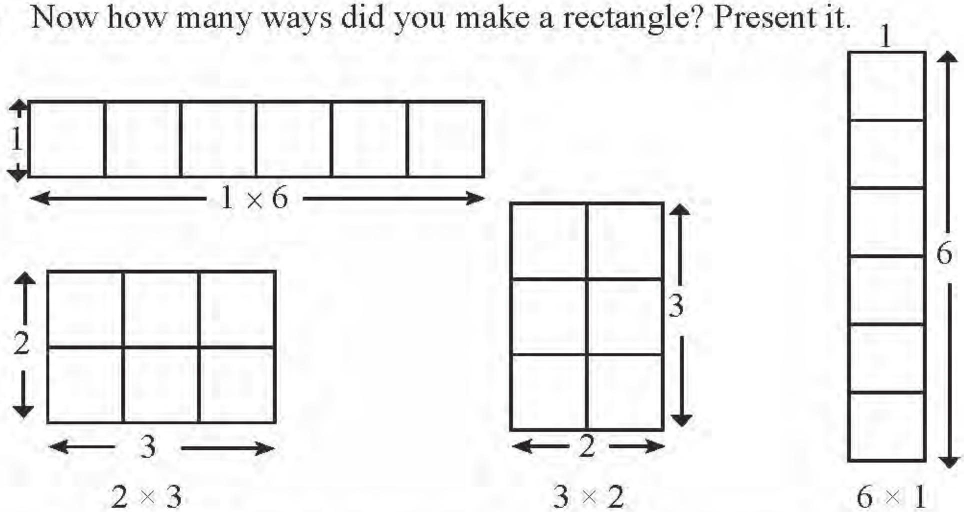
Activity 1.

(a) Take 6 square pieces of paper of length 1 cm:



(b) How many ways can you make a rectangle by combining these 6 pieces of paper? Try it.

(c) Now how many ways did you make a rectangle? Present it.



Here, rectangles of size 1 × 6, 2 × 3, 3 × 2 and 6 × 1 are made in four ways by combining 6 square pieces. Here, 6 is exactly divisible by 1, 2, 3 and 6. So 1, 2, 3 and 6 are factors of 6.

Activity 2

(a) Write down the numbers whose product is 12 as shown below:

$1 \times 12 = 12$	$4 \times 3 = 12$
$2 \times 6 = 12$	$6 \times 2 = 12$
$3 \times 4 = 12$	$12 \times 1 = 12$

(b) Now, which numbers are multiplied so the product is 12? Which numbers divide 12 exactly? Present in the classroom.

Multiplying 1 and 12, 2 and 6, 3 and 4, 4 and 3, 6 and 2, 12 and 1 gives the product 12. 12 is exactly divisible by 1, 2, 3, 4, 6 and 12. So the factors of 12 are 1, 2, 3, 4, 6 and 12. The set of factors of 12 is denoted by F_{12}.

$\therefore F_{12} = \{1,2,3,4,6,12\}$ can be written.

The number that divides any number exactly is called the factor of that number. Factors of any number are at least 1 and the same number.

Example 1

Write the factors of 18:

Solution:

Here, when multiply two numbers whose product is 18 are shown below:

$1 \times 18 = 18$

$2 \times 9 = 18$

$3 \times 6 = 18$

$6 \times 3 = 18$

$9 \times 2 = 18$

$18 \times 1 = 18$

$$\begin{array}{r|l} 2 & 18 \\ \hline 3 & 9 \\ \hline 3 & 3 \\ \hline & 1 \end{array}$$

$\therefore$ Since 18 is exactly divisible by 1, 2, 3, 6, 9 and 18, the factors of 18 are 1, 2,3, 6, 9 and 18.

2.4.2 Multiples

Activities 1.

(a) Write a multiplication table of 5:

$5\times1 = 5$

$5\times2 = 10$

$5\times3 = 15$

$5\times4 = 20$

$5\times5 = 25$

$5\times6 = 30$

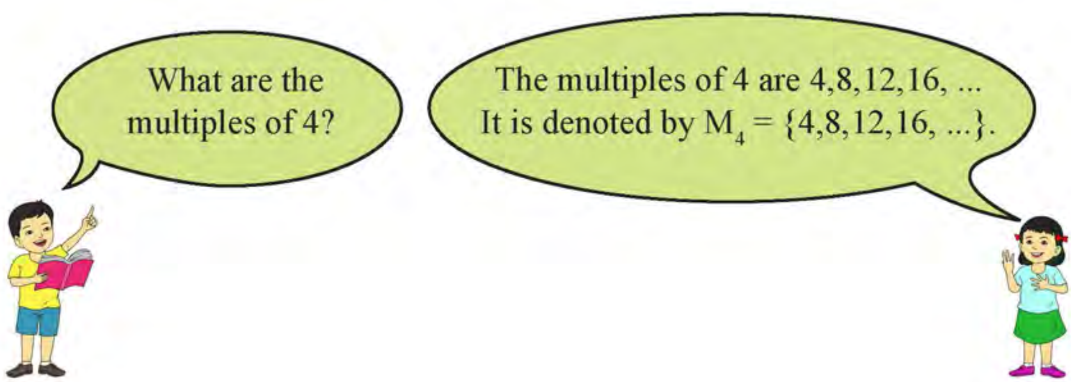
$5\times7 = 35$

…

(b) Are all the numbers {5, 10, 15, 20, 25, 30, …} exactly divisible by 5?

(c) What is called {5, 10, 15, 20, 25, 30, …} of 5? Discuss it.

{5, 10, 15, 20, 25, 30, …} is a set of multiples of 5. It is denoted by M_5. Such as in $5 \times 6 = 30$, 5 and 6 are called the factors of 30 and 30 is called the multiple of 5 and 6.



The product of any number multiplied by natural numbers respectively are called the multiples of that number. For example, the set of multiples of 5 is {5, 10, 15, 20, 25, ...).

Example 2

Write the set of first ten multiples of 8.

Solution:

Set of the first ten multiples of 8

$M_8 = \{8, 16, 24, 32, 40, 48, 56, 64, 72, 80\}$

$8 \times 1 = 8$	$8 \times 6 = 48$
$8 \times 2 = 16$	$8 \times 7 = 56$
$8 \times 3 = 24$	$8 \times 8 = 64$
$8 \times 4 = 32$	$8 \times 9 = 72$
$8 \times 5 = 40$	$8 \times 10 = 80$

Exercise 2.4

1. **Write the sign (√) for the correct statement and the sign (x) for the false statement given below:**

   (a) One factor of any number is 1.

   (b) In $8\times7 = 56$, 8 and 7 are both multiples of 56.

   (c) In $9 \times8 = 72$, 72 is called multiple of 8 and 9.

   (d) The product of any number multiplied by the natural numbers respectively are the multiples of that number.

   (e) A set of factors of 24 is are {1, 2, 3, 4, 6, 8, 12, 24}.

2. **Write the set of factors of the following given number:**

   (a) 12 (b) 13 (c) 18 (d) 32 (e) 9

3. **Write the set of first ten multiples of each of the numbers given below:**

   (a) 5 (b) 6 (c) 9 (d)7 (e)11

4. **Answer the following given questions.**

   (a) Write the set of multiples of 4 less than 20.

   (b) Write the set of multiples of 2 less than 20.

   (c) Are all the multiples of 4 also the multiples of 2?

5. **Make a list and write in set:**

   (a) Set of factors of 12, F_{12}

   (b) Set of factors of 18, F_{18}

   (c) Write the common members of F_{12} and F_{18}.

6. **If a school bell is rung in every 45 minutes time interval in the school, then how many times does the school bell ring in 3 hours?**

Project Work

Make a rectangle by combining 8 square pieces of paper. Based on that, find the factors of 8 and present it in the classroom.

Answer

Show all the answers to your teacher.

2.5 Prime factorization

2.5.1 Prime and composite numbers

Activity 1

The table shows the factors of numbers from 1 to 10. Observe the table and discuss the following given questions:

Numbers	Factors	Number of factor
1	1	1
2	1, 2	2
3	1, 3	2
4	1, 2, 4	3
5	1, 5	2
6	1, 2, 3, 6	4
7	1, 7	2
8	1, 2, 4, 8	4
9	1, 3, 9	3
10	1, 2, 5, 10	4

(a) What is the number having only one factor?

(b) What numbers have only two factors?

(c) What are the numbers having more than two factors?

In the above table, the number 1 has only one factor. There is only one factor of 1 in the table above. The numbers 2,3,5 and 7 have only two factors. Numbers with more than two factors are 4,6,8,9 and 10.

- The numbers having only two factors 1 and that numbers itself are called prime numbers, such as: 2, 3, 5, 7, ...
- Numbers having more than two factors are called composite numbers, such as: 4, 6, 8, 9, 10, ...

2.5.2 Prime factorization

Activity 1.

Step I: Take a composite number, for example: number 24 is taken.

Step II: How many ways the number can be expressed as the product of the factors? Write it.

$1 \times 24 = 24$	$6 \times 4 = 24$
$2 \times 12 = 24$	$8 \times 3 = 24$
$3 \times 8 = 24$	$12 \times 2 = 24$
$4 \times 6 = 24$	$24 \times 1 = 24$

Here, 24 is written in the form of product in 8 ways.

Step III: Are the factors of 24 prime numbers in all cases? In all cases, the factors of 24 are not prime numbers.

Step IV: The factors of 24 into prime numbers:

1 × 24 = 24	→	1 × 24	→	2 × 2 × 2 × 3
2 × 12 = 24	→	2 × 2 × 6	→	2 × 2 × 2 × 3
3 × 8 = 24	→	3 × 2 × 4	→	3 × 2 × 2 × 2
4 × 6 = 24	→	2 × 2 × 2 × 3	→	2 × 2 × 2 × 3
6 × 4 = 24	→	2 × 3 × 2 × 2	→	2 × 3 × 2 × 2
8 × 3 = 24	→	2 × 4 × 3	→	2 × 2 × 2 × 3
12 × 2 = 24	→	2 × 6 × 2	→	2 × 2 × 3 × 2
24 × 1 = 24	→	24 × 1	→	2 × 2 × 2 × 3

Here, the factors of 24 in the third table are all prime numbers. So the prime factor of 24 is 2×2×2×3.

Expressing any composite number as all a product of prime numbers is called prime factorization of that number, for example: 24 = 2×2×2×3

Method of prime factorization

Method 1: Division method

Example 1: Prime factorize 486 by division method:

Solution:

Given number = 486	Step I: The number 486 is an even number. So it is exactly divisible by 2. That is 2×243 = 486. $\begin{array}{r} 243 \\ 2\overline{)486} \\ -4\downarrow \\ \hline 8 \\ -8 \\ \hline 6 \\ -6 \\ \hline 0 \end{array}$

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$$\begin{array}{r|l} 2 & 486 \\ \hline 3 & 243 \\ \hline 3 & 81 \\ \hline 3 & 27 \\ \hline 3 & 9 \\ \hline & 3 \end{array}$$

Therefore,

$486 = 2 \times 3 \times 3 \times 3 \times 3 \times 3$

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Step II: In number 243, $2 + 4 + 3 = 9$.
9 is exactly divisible by 3.
So 243 is exactly divisible by 3.
That is $3 \times 81 = 243$.

$$\begin{array}{r} 81 \\ 3\overline{)243} \\ -24\downarrow \\ \hline 3 \\ -3 \\ \hline 0 \end{array}$$

Step III: In number 81, $8 + 1 = 9$.
9 is exactly divisible by 3.
So 81 is also exactly divisible by 3.
That is $3 \times 27 = 81$.

$$\begin{array}{r} 27 \\ 3\overline{)81} \\ -6\downarrow \\ \hline 21 \\ -21 \\ \hline 0 \end{array}$$

<hr>

Step IV: Dividing 27 by 3 makes the quotient 9.

Step V: Dividing 9 by 3 makes the quotient 3.

Step VI: Finally the quotient 3 is a prime number.

So the factor of $486 = 2 \times 3 \times 3 \times 3 \times 3 \times 3$.

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Example 2

Using division method to find the prime factor of 630:

Solution:

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Given number = 630

$$\begin{array}{r|l} 2 & 630 \\ \hline 3 & 315 \\ \hline 3 & 105 \\ \hline 5 & 35 \\ \hline & 7 \end{array}$$

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Step I: Since the number 630 is an even number, it is exactly divisible by 2.Since there is zero in the place of one, it is also exactly divisible by 5. So we can divide number 630 by both 2 and 5.

Step II: Since the number 315 is odd number, it is not divisible by 2. Now, let us find the sum of the digits of this number, to check whether it is divisible by 3 or not.

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Hence, $630 = 2 \times 3 \times 3 \times 5 \times 7$	$3 + 1 + 5 = 9$, 9 is exactly divisible by 3. So 315 is exactly divisible by 3. Step III: 105 contains $1 + 0 + 5 = 6$.6 is exactly divisible by 3. So 105 is exactly divisible by 3. Step IV: Dividing 35 by 5 makes the quotient 7. Step V: 7 is a prime number so you have to stop dividing process. So 630 is prime factorised, then $630 = 2 \times 3 \times 3 \times 5 \times 7$.

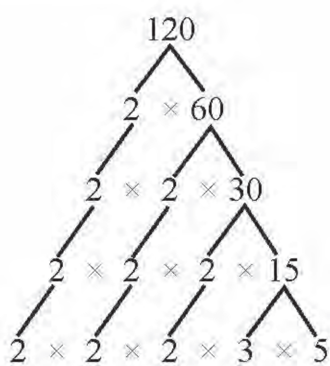
Method 2: Tree diagram method of factors

Example 3

Show the factor of 120 by making tree diagram.

Solution:

Given number = 120



$$
\begin{aligned}
120 &= 2 \times 60 \\
&= 2 \times 2 \times 30 \\
&= 2 \times 2 \times 2 \times 15 \\
&= 2 \times 2 \times 2 \times 3 \times 5
\end{aligned}
$$

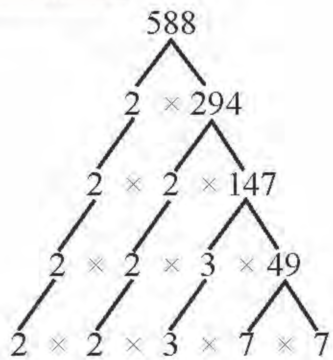
$\therefore 120 = 2 \times 2 \times 2 \times 3 \times 5$

Example 4

Show the factor of 588 by making tree diagram:

Solution:

Given number = 588



294 is a composite number.

147 is a composite number.

49 is a composite number.

7 is a prime number.

(So, now stop the process.)

$\therefore 588 = 2 \times 2 \times 3 \times 7 \times 7$

Exercise 2.5

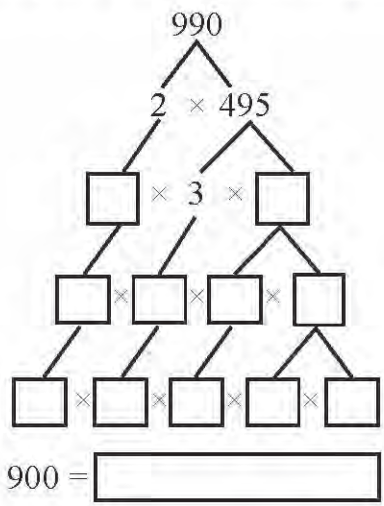
1. **Write the sign (√) for the correct statement and the sign (x) for the false statement given below:**
   (a) The smallest prime number is 1.
   (b) All prime numbers are odd.
   (c) 2 is only a prime number out of even numbers.
   (d) Writing any number as a product of prime numbers is prime factorization of that number.
   (e) The prime factorization of 20 is represented by $2\times2\times5$.

2. **Fill in the blanks:**
   (a) Write in the multiplication form by multiplying the prime factors of 144, as in the following example.

Example: $120 = 2\times2\times2\times3\times5$

$144 = \boxed{}$

(b) Complete the given tree diagram:



3. Prime factorise each of the following numbers by division method:

(a) 275 (b) 729 (c) 625 (d) 288 (e) 720

4. Prime factorise each of the following numbers by the tree diagram method:

(a) 180 (b) 800 (c) 540 (d) 825 (e) 108

5. Find the prime factors of 450 and 240 and also write the common factors of both.

Answer

1. Show the answer to your teacher.
2. Show the answer to your teacher.
3. (a) $5\times5\times11$ (b) $3\times3\times3\times3\times3\times3$ (c) $5\times5\times5\times5$
   (d) $2\times2\times2\times2\times2\times3\times3$ (d) $2\times2\times2\times2\times3\times3\times5$
4. Show the answer to your teacher.
5. The common factors are 5 and 3.

2.6 Square number and square root

Activities 1

Study the multiplication table given below and discuss the following questions:

×	1	2	3	4	5	6	7	8	9	10
1	1	2	3	4	5	6	7	8	9	10
2	2	4	6	8	10	12	14	16	18	20
3	3	6	9	12	15	18	21	24	27	30
4	4	8	12	16	20	24	28	32	36	40
5	5	10	15	20	25	30	35	40	45	50
6	6	12	18	24	30	36	42	48	54	60
7	7	14	21	28	35	42	49	56	63	70
8	8	16	24	32	40	48	56	64	72	80
9	9	18	27	36	45	54	63	72	81	90
10	10	20	30	40	50	60	70	80	90	100

(a) Are the coloured numbers in the above table the product of two identical numbers?

(b) What would be the shortest way to find each coloured number? The coloured numbers in the above table can be found by multiplying two identical numbers, such as:

$1 \times 1 = 1$

$2 \times 2 = 4$

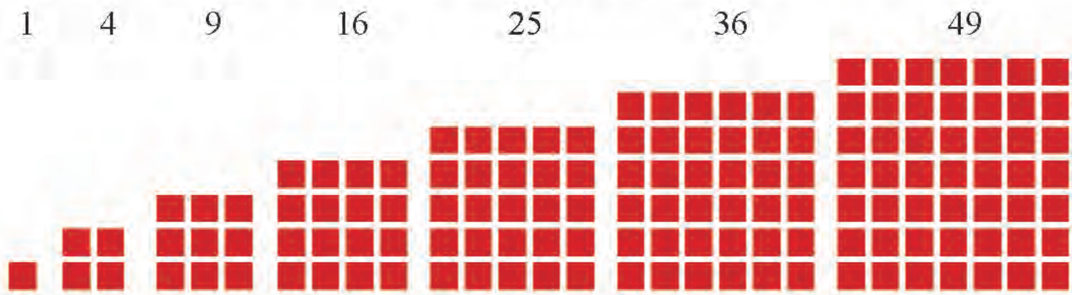
$3 \times 3 = 9$

Express all the remaining coloured numbers in the above table in the same way.

Activity 2

Step I: Take a piece of paper. On that paper, the numbers from 1 to 50 are arranged in square form equal to the number of dots in each row and column.

Step II: Which numbers can you arrange in a square form? Write it.



The numbers that can be arranged in square forms are called square numbers. In the above figure, the total number of squares represents the square number and the number of square in a row or a column represents the square root, for example: the square root of 49 is 7 and the square number of 7 is 49. (For this, instead of making squares, you can also use corn kernels, soybean kernels or lapsi kernels etc.)

Activity 3

Complete the table given below, discuss and write.

Numbers	The product of multiplying that number by itself	Square root of given number	When you take one of the two similar factors	Conclusion
1	$1 \times 1 = 1^2 = 1$	1	1	The Square root of $1 = 1$
2	$2 \times 2 = 2^2 = 4$	4	2	The Square root of $4 = 2$
3	$3 \times 3 = 3^3 = 9$	9	3	The Square root of $9 = 3$
4				
5				
6				
7				
8				
9				
10				

The product of any number multiplied by that number itself is the square number of that number.

If a number can be expressed as the product of two identical factors, then one factor is called the square root of that number.

Example 1

Lakshmi wants to plant cabbage seedlings in her *karesabari* with equal numbers in the columns and rows. If she plants 6 seedlings of cabbage in each column, how many total cabbage seedlings will be needed?

Solution:

Here, the number of cabbage seedlings in each column= 6

The number of cabbage seedlings in each row = 6

Total number of cabbage seedlings = $6 \times 6 = 36$

Example 2

How many students are placed in each column when 81 students are arranged together in a square form equally in each row and column to play physical exercises?

Solution:

The total number of students = 81

$81 = 9 \times 9$

Therefore, 9/9 students should be placed in each column.

Exercise 2.6

1. **Write the sign (√) for the correct statement and the sign (x) for the false statement given below:**

   (a) A pattern arranged in such a way that each row and column has an equal number is called a square pattern.

   (b) The result of squaring the odd number is always odd.

(c) One factor out of the two identical factors is called a square number.

(d) 82 is a square number.

(e) The square root of 36 is 6.

2. **Find the square number of the following given numbers:**

   (a) 1 (b) 6 (c) 4 (d) 10

3. **Find the square root of the following given numbers:**

   (a) 4 (b) 49 (c) 36 (d) 64

4. **Separate the square numbers from the following given numbers:**

   (a) 21 (b) 25 (c) 63 (d) 36 (e) 4 (f) 49 (g) 99 (h) 1

5. **Which number is multiplied by itself that gives the product 81?**

6. **How many soldiers are involved in each row when 100 soldiers are arranged together in a square form equally in each row and column to play the parade?**

7. **When 9 students are arranged in a line of a square form, 3 students come to be more. How many students are there in total?**

8. **When 8 students are arranged in a line of a square form, 5 more students are needed. How many students were there at the beginning?**

Project Work:

Which of the numbers from 1 to 100 can be arranged in the square form? Show that numbers on the chart paper in the square form and present it in the classroom.

Answer:

Show the answer of 1 to 4 to your teacher.

5. 9 6. 10 7. 84 8. 59

2.7 Highest common factor

Activity 1

The numbers 1 to 6 are given in the table below. Fill their factors in the table. Now discuss in the following questions based on that table:

Numbers	Factors
1	
2	
3	
4	
5	
6	

(a) What are the common factors of 2 and 4?

(b) Which is the largest common factors of 2 and 4?

The factors in both the numbers are called their common factors.

Activity 2

Step I: Take the paper strips or sticks of length 4 units and 10 units.

Step II: Now, measure both strips or sticks alternately by strips of paper or stick of length 1 unit, 2 unit, 3 unit and 4 unit.

Step III: Which unit strips of paper or stick can be measured both strips or stick exactly? Write it. (Both can be measured by 1 unit and 2 units.)

Step IV: Large measurement out of different measurements of strips of paper or stick which can be measured both exactly is H.C.F. So, the H.C.F. of 4 and 10 is 2.

Methods of finding the highest common factor

Method 1: By making a set of factors

Step 1: Take any two numbers, for example: 27 and 36.

Step II: Take a number chart written from 1 to 100.

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

Step III: Put the circle (O) to the numbers which divides 27 exactly or the factors of 27 on the number chart with a red sign pen.

Step IV: In the same number chart, put the sign (X) to the numbers which divides 36 exactly or the factors of 36 with a green sign pen.

Step V: Now what are the numbers having both the circle (O) and the sign (X)? Find out.

Step VI: Write the largest number out of the numbers having both signs (O) and (X). That number is the H.C.F.

Example 1

Find the H.C.F. of the numbers 27 and 36 by making the set of factors.

Solution:

Set of factors of 27 = {1, 3, 9, 27}

Set of factors of 36 = {1, 2, 3, 4, 6, 9, 12, 18, 36}

Set of common factors = {1, 3, 9}

Largest common factor = 9

So, the H.C.F. of 27 and 36 is 9.

The largest common factor among the common factors of the given numbers is called the Highest Common Factor of those numbers. That is, the largest number that divides the given numbers exactly is the highest common factor (H.C.F.) of that numbers. It is written as H.C.F. in short form.

Method 2: Prime factorization method

First, find the prime factors of the given numbers. Then, find the H.C.F. by calculating the product of the common prime factors.

Example 2

Find the H.C.F. of 24 and 60 by prime factorization method.

Solution:

$$\begin{array}{r|l} 2 & 24 \\ \hline 2 & 12 \\ \hline 2 & 6 \\ \hline & 3 \end{array} \qquad \begin{array}{r|l} 2 & 60 \\ \hline 2 & 30 \\ \hline 3 & 15 \\ \hline & 5 \end{array}$$

(a) Prime factorise the given numbers.
(b) Take common prime factors among their prime factors.
(c) Find the product of common prime factos. That product is H.C.F.

$24 = 2 \times 2 \times 2 \times 3$

$60 = 2 \times 2 \times 3 \times 5$

common factors $= 2 \times 2 \times 3$

Therefore, H.C.F. $= 2 \times 2 \times 3 = 12$.

Example 3

Find the H.C.F. of 12, 15 and 18 by prime factorization method.

Solution:

$$\begin{array}{r|l} 2 & 12 \\ \hline 2 & 6 \\ \hline & 3 \end{array} \qquad \begin{array}{r|l} 3 & 15 \\ \hline & 5 \end{array} \qquad \begin{array}{r|l} 2 & 18 \\ \hline 3 & 9 \\ \hline & 3 \end{array}$$

$12 = 2 \times 2 \times 3$

$15 = 3 \times 5$

$18 = 2 \times 3 \times 3$

common factor $= 3$

Therefore, H.C.F. $= 3$

When taking a common factor, you have to take the factor of all the three.

Exercise 2.7

1. **Write the sign (√) for the correct statement and the sign (×) for the false statement given below:**
   (a) There is only one factor of a prime number.
   (b) The largest common factor of numbers 25 and 45 is 5.
   (c) The smallest number that divides the given numbers exactly is H.C.F.
   (d) The numbers 55 and 33 exactly divisible by the largest common factor 11 is their H.C.F.
2. **Find the H.C.F. of the following given numbers by forming a set of factors:**
   (a) 18 and 24 (b) 14 and 21 (c) 16 and 24 (d) 48 and 72 (e) 36 and 48
3. **Find the H.C.F. of the following given numbers by the method of prime factors:**
   (a) 42 and 56 (b) 60 and 75 (c) 54 and 90 (d) 45 and 60
   (e) 18 and 27 (f) 12, 15 and 21 (g) 18, 24 and 36 (h) 14, 28 and 35
   (i) 16, 24 and 40 (j) 30, 75 and 90
4. **Find the largest number that divides 48 and 84 exactly.**
5. **Find the greatest number of people to whom 25 oranges and 30 amalas can be distributed equally.**

Project work

In a number chart written from 1 to 100, find the H.C.F. by marking circle (O) in the factors of 36, 60 and 90 with a different coloured sign pen and present it in the classroom.

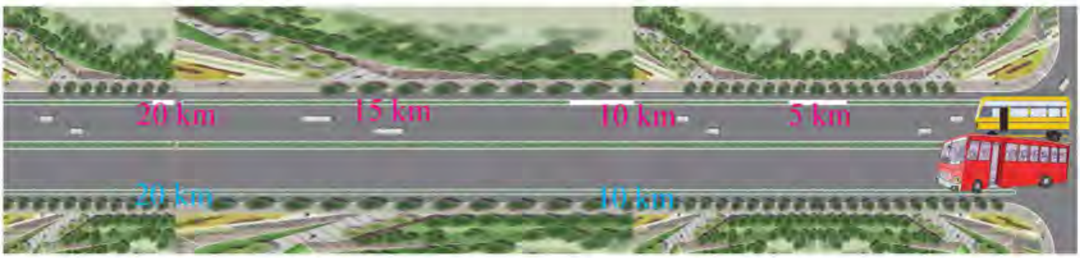
Answer

1. Show the answer to your teacher.
2. (a) 6 (b) 7 (c) 8 (d) 24 (d) 12
3. (a) 14 (b) 15 (c) 18 (d) 15 (e) 9
   (f) 3 (g) 6 (h) 7 (i) 8 (j) 15
4. 12 5. 5

2.8 Lowest common multiples

Activity 1

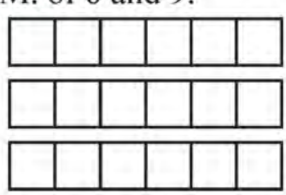
Discuss in the group. Two buses started running from the same bus park. There are the bus stations in the difference of every 5 km of the first bus. If there are the bus stations in the difference of every 10 km of the next bus, what is the first common station of both the buses? How many km far is the bus station from the bus park?



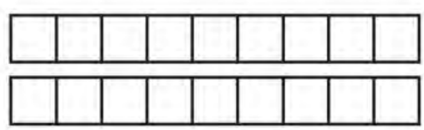
In the above figure, the yellow bus shows the multiples of 5 as it moves. Similarly, as the red bus moves, the multiples of 10 appear to be formed. Both buses have met twice at a distance of 10 km and 20 km from the bus park. The first meeting at the station is at the distance of 10 km from the bus park. The smallest multiple of 5 and 10 is 10. Here the least common multiple of 5 and 10 is 10. It is written in the short form as L.C.M. and is called Lowest Common Multiple (L.C.M.) in English.

Activity 2

Step I: Take the strips of paper of length 6 units and 9 units for finding the L.C.M. of 6 and 9.



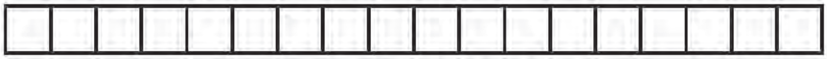
Strips of paper of 6 units



Strips of paper of 9 units

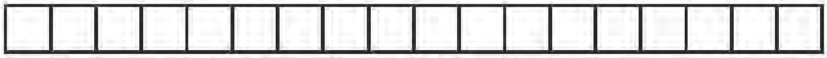
Step II: Since these two strips are not equal, add another strip of 6 units to the strip of 6 unit length:

Step III: Add another strip of 9 units to the strip of 9 unit length:



Step IV: Continue this process until the length of both strips is equal.

(Re-add a strip of 6 units to the diagram of step II.)



The total length is 18 units. The length of both the strips become 18 units. Therefore, L.C.M. of 6 and 9 is 18.

The lowest number which is exactly divisible by the given numbers is called Lowest Common Multiple of the given numbers. The lowest common multiple is written as L.C.M. in short form.

Methods for finding L.C.M.:

Method 1: By making set of multiples

If the given numbers are small, L.C.M. can be found by making set of multiples.

Activity 3

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

Step I: Take any two numbers, such as: 6 and 9.

Step II: Take a number chart of the numbers written from 1-100:

Step III: Mark the circle to the multiples of 6 in the number chart with a black sign pen.

Step IV: Mark the sign (X) to the multiples of 9 in the number chart with a blue sign pen.

Step V: Which numbers are having both circle (O) and sign (x)? Find it.

Step VI: Write the smallest number among the numbers having both sign. That number is the L.C.M. of 6 and 9.

Example 1

Find the L.C.M. of 12 and 18 by making set of multiples.

Solution:

Multiples of 12 = {12, 24, 36, 48, 60, 72, 84, ...}

Multiples of 18 = {18, 36, 54, 72, 90, ...}

Common multiples of 12 and 18 = {36, 72, ... }

36 is the smallest multiple in the set of common multiples. So the L.C.M. of 12 and 18 is 36.

Method 2: Prime factorization method

First of all find the prime factors of the given numbers. Then find the L.C.M. by calculating the product of the common prime factors and the remaining prime factors.

Example 2

Find the L.C.M. of 24 and 36 by prime factorization method:

Solution:

$$\begin{array}{r|l} 2 & 24 \\ \hline 2 & 12 \\ \hline 2 & 6 \\ \hline & 3 \end{array} \qquad \begin{array}{r|l} 2 & 36 \\ \hline 2 & 18 \\ \hline 3 & 9 \\ \hline & 3 \end{array}$$

(a) Prime factorise the given numbers.

(b) Take common prime factors among their prime factors.

(c) Take the remaining prime factors.

(d) Find the product of the common and the remaining prime factors. That product is L.C.M.

$24 = 2 \times 2 \times 2 \times 3$

$36 = 2 \times 2 \times 3 \times 3$

The common factor of 24 and 36 $= 2 \times 2 \times 3 = 12$

The remaining factor $= 2 \times 3 = 6$

L. C.M. = common factor × remaining factor

$= 12 \times 6 = 72$

Therefore, L.C.M. = 72

Activity 3

Find the H.C.F. and L.C.M. of the numbers 22 and 33 by presenting their factors in the figure.

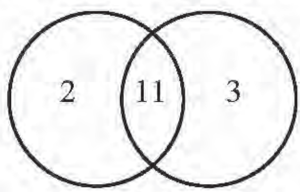
Step I: Find the factors of 22 and 33.

$\begin{array}{r|l} 2 & 22 \\ \hline & 11 \end{array} \qquad \begin{array}{r|l} 3 & 33 \\ \hline & 11 \end{array}$

$11 = 2 \times 11$

$33 = 3 \times 11$

Step II: Now represent the factors of 22 and 33 in the figure.



Step III: The common factor 11 of both numbers is H.C.F.

Step IV: Find the product of the common factors and the remaining factors of both the numbers.

$11 \times 2 \times 3 = 66$ is L.C.M.

Now the product of the given numbers $= 22 \times 33 = 726$

The product of H.C.F. and L.C.M. $= 11 \times 66 = 726$

Example 3

Show that the product of numbers 24 and 36 is equal to the product of their H.C.F. and L.C.M.:

Solution:

Here, H.C.F. of 24 and 36 = 12 (Taken from example 2)

L.C.M. of 24 and 36 = 72

L.C.M.×H.C.F. = first number × second number

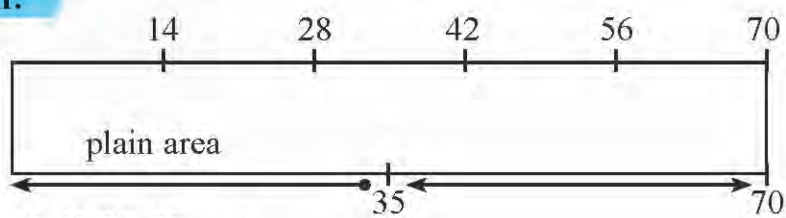
or, 72 × 12 = 24 ×36

Therefore, 864 = 864. Hence proved.

Example 4

How long does the shortest distance can be measured by two rods having length 14 cm and 35 cm together? What does this distance denote?

Solution:



$M_{14} = \{14, 28, 42, 56, 70, \ldots\}$

$M_{35} = \{35, 70, \ldots\}$

The shortest distance measured by both rods is 70 cm. It is called L.C.M.

∴ L.C.M. = 70 cm

Exercise 2.8

1. **Write the sign (√) for the correct statement and the sign (×) for the false statement given below:**

   (a) A smallest number which is exactly divisible by the given numbers is L.C.M. of the given numbers.

   (b) A smallest number 165 which is exactly divisible by the numbers 55 and 33 is L.C.M. of 55 and 33.

   (c) The smallest number which divides exactly the given numbers is the L.C.M. of those numbers.

   (d) When the product of two numbers is divided by H.C.F., the quotient is the L.C.M. of the numbers.

(e) The common multiples of the numbers 12 and 24 is a set {12, 24, 36, ...}

2. Calculate the L.C.M. of the following given numbers by making set of multiples:

(a) 10, 15 (b) 11, 22 (c) 12, 16 (d) 15, 18 (e) 8, 12 (f) 12, 15

3. Calculate the L.C.M. of the following given numbers by prime factor method:

(a) 20.25 (b) 32, 36 (c) 72.96 (d) 24, 30 (e) 42, 70

4. Find the smallest number that is exactly divisible by 75 and 90.

5. Find the smallest number that is exactly divisible by 36 and 90.

6. (a) Find the product of 30 and 42.

(b) Find the L.C.M. and H.C.F. of 30 and 42.

(c) Find the product of L.C.M. and H.C.F.

(d) Compare the results of (a) and (c).

7. Show that the product of the numbers 12 and 16 is equal to the product of their H.C.F. and L.C.M.

8. If the H. C. F. of the numbers 24 and 40 is 8, find the L.C. M.

9. Two measuring tapes are of length 20 cm. and 30 cm. Now which tape having the shortest length can be measured by both of these tapes with exactly divisible? Find out.

Project Work:

Take a cardboard paper and show the factors of two numbers 35 and 28 in the picture. Then find out their H.C.F. and L.C.M. and present it in the classroom.

Answer

1. Show the answer to the teacher.
2. (a) 30 (b) 22 (c) 48 (d) 90 (e) 24 (f) 60
3. (a) 100 (b) 288 (c) 288 (d) 120 (e) 420
4. 450 5. 180 Show the answer of 6 to 9 to the teacher.

Lesson-3

Integers

3.0 Review

Activity 1

Take any two numbers from the set of whole numbers W = {0, 1, 2, 3, ...}.Which of the operations out of addition, subtraction and multiplication of these numbers will be possible? Discuss by finding the sum, difference and product.

3.1 Introduction to integers

Activity 2

Take two numbers 2 and 3 from the set of whole numbers (W) = {0, 1, 2, 3, ...}. Find the sum, product and difference of the numbers. What is the result? Discuss it.

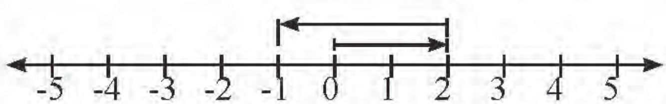
Here,

$2 + 3 = 5$

$2 \times 3 = 6$

$2 - 3 = ?$

When two numbers 2 and 3 is added, then the sum is 5 and when 2 and 3 is multiplied then the product is 6. These both are whole numbers. That is, the sum and product of two whole numbers is always a whole number. But what will be the result of subtracting 3 from 2? Find out by observing the number line below.



From the number line, 2 -3 is known to be a number less than 0 by 1 unit. It is written as -1. Similarly 4-6 = -2 (less than 2 with respect to 0), 3-6 = -3 (less than 3 with respect to 0) etc.

Here, -1, -2 and -3 are not whole numbers.

Such numbers are negative numbers.

The set of negative numbers, zero and positive numbers is called integers. The set of integers is written as Z = {…, -2, -1, 0, 1, 2. …..}. The set of integers can be shown in the number line as follows.

Moving from zero to the right, the value of the numbers are increasing and while moving to the left from zero, the value of the numbers are decreasing. The place where 0 is written on the number line is called the point of origin. The numbers on the right from the point of origin are positive and the numbers on the left are negative. $Z^+ = \{+1, +2, +3, \ldots\}$ is called a set of positive integers and $Z^- = \{-1, -2, -3, -4, \ldots\}$ is called a set of negative integers.

A set of numbers formed from a set of positive numbers, zero and a set of negative numbers is called a set of integers. Zero (0) is neither negative nor positive.

Exercise 3.1

1. **Write the sign (√) for the correct statement and the sign (×) for the false statement given below:**
   (a) Zero is a positive number.
   (b) A number greater than zero falls to the right from the point of origin.
   (c) A number 1 unit smaller than any number falls to the right of that number.
   (d) Negative integers fall to the left from the point of origin.
   (e) In -6 and -5, -6 is the larger integer.
2. **Separate the integers from the numbers given below:**

   -2, 0, -5, 40, 1.5, $\frac{1}{2}$, 0.66, -75, 100, $\frac{2}{3}$

3. **Write the numbers 4 units to the left from the following number based on the number line:**

   (a) 6 (b) -2 (c) 0 (d) 3 (e) -5

4. **Put sign (>) or (<) in the box between the following two numbers:**

   (a) -2 $\square$ 0 (b) -12 $\square$ -5 (c) -21 $\square$ -23

   (d) -8 $\square$ 8 (e) -33 $\square$ 0

5. **Re-arrange the integers in an ascending order.**

   (a) -2, 0, -6, 4, 1 (b) 5, 8, -3, -4, 0, 9

   (c) -40, 33, 11, -15, -22, 2

6. **Write the numbers between the integers given below using the number line:**

   (a) -2 and 3 (b) -8 and -15 (c) -7 and 0 (d) -13 and -18

7. **Location A is 5 km east from the temple and location B is 3 km west of the temple. Show this information using integers on the number line. Also find the distance between location A and B.**

Project Work

Where are the integers used in our daily lives and how? Ask about it to your elders or search in the internet. Then write six examples of that and present them in the classroom.

Answer

Show the answers from 1 to 4 to your teacher.

5. (a) -6, -2, 0, 1, 4 (b) -4, -3, 0, 5, 8, 9 (c) -40, -22, -15, 2, 11, 33
6. (a) -1, 0, 1, 2 (b) -14. -13, -12, -11, -10, -9
   (c) -6, -5, -4, -3, -2, -1 (d) -14, -15, -16, -17
7. 8 km

Lesson 4

Fraction

4.0 Review

Discuss the following given situations in groups. Each group should study one sentence and present its fraction form in the classroom:

(a) Rama divided a bread into four equal portions and ate three portions.

(b) Praveen could read seven pages in a ten pages long story.

(c) Hari's father ate a quarter of a bread.

4.1 Equivalent fractions

Activity 1

Step I: Take two circular papers of the same size. Fold one circular paper into two equal parts as given in figure no. 1 and put a colour in one part.

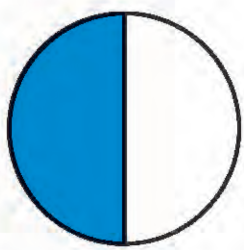


Figure No. 1

Step II: Similarly, fold the next paper into four equal parts as in figure no. 2 and put the colour in two parts.

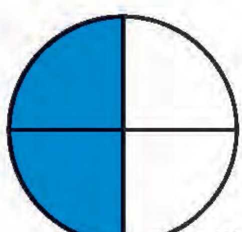


Figure No. 2

The first figure has a coloured part $\frac{1}{2}$ and the second figure has a coloured part $\frac{2}{4}$ but when you trace both figures from a transparent paper, you can see that the equal parts are coloured. $\frac{1}{2}$ and $\frac{2}{4}$ represent equal portion. These are called equivalent fractions.

Other fractions that are equal to one fraction are called equivalent fractions of that fraction.

Activity 2

●	Take a rectangular paper.	
●	Fold the paper into two equal parts and colour one part. Here the coloured part is denoted by $\frac{1}{2}$.	
●	Again, fold the same paper into four equal parts. Here, the coloured part is denoted by $\frac{2}{4}$.	
●	In the same way, fold the same paper into eight equal parts. Here, the coloured part is denoted by $\frac{4}{8}$.	

The coloured parts in the above three figures are equal. So, all fractions $\frac{1}{2} = \frac{2}{4} = \frac{4}{8}$ denote the same fraction. Therefore, $\frac{1}{2}$, $\frac{2}{4}$ and $\frac{4}{8}$ are equivalent fractions.

Method 1

We made equivalent fractions through diagram in the above. Now, let's try to make the same equivalent fraction in another way.

Example 1

Write the equivalent fractions of $\frac{1}{2}$

Solution:

$\frac{1}{2} = \frac{1 \times 2}{2 \times 2} = \frac{2}{4}$ (Multiplying both the numerator and the denominator by 2)

$\frac{1}{2} = \frac{1 \times 3}{2 \times 3} = \frac{3}{6}$ (Multiplying both the numerator and the denominator by 3)

$\frac{1}{2} = \frac{1 \times 4}{2 \times 4} = \frac{4}{8}$ (Multiplying both the numerator and the denominator by 4)

$\frac{1}{2} = \frac{1 \times 5}{2 \times 5} = \frac{5}{10}$ (Multiplying both the numerator and the denominator by 5)

So, we can write $\frac{1}{2} = \frac{2}{4} = \frac{3}{6} = \frac{4}{8} = \frac{5}{10}$

Therefore, the equivalent fractions of $\frac{1}{2}$ are $\frac{2}{4}, \frac{3}{6}, \frac{4}{8}$ and $\frac{5}{10}$

Method II

Any fraction can be multiplied by the same number in both denominator and numerator to make an equivalent fraction.

Example 2

Write the equivalent fractions of $\frac{3}{4}$

Solution:

$\frac{3}{4} = \frac{3 \times 2}{4 \times 2} = \frac{6}{8}$

$\frac{3}{4} = \frac{3 \times 3}{4 \times 3} = \frac{9}{12}$

$\frac{3}{4}$

$\frac{3}{4} = \frac{3 \times 4}{4 \times 4} = \frac{12}{16}$

$\frac{3}{4} = \frac{3 \times 5}{4 \times 5} = \frac{15}{20}$

Similarly many more equivalent fractions can be shown by adding other branches.

Example 3

Write an equivalent fraction of $\frac{3}{4}$, having 12 in the denominator.

Solution:

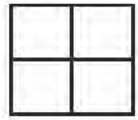
$\frac{3}{4} = \frac{3 \times 3}{4 \times 3} = \frac{9}{12}$

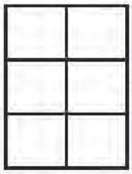
To make 12 in the denominator of the given fraction, multiply both the numerator and the denominator by 3.

Exercise 4.1

1. **Colour the parts which represent the given fraction in the figure below:**

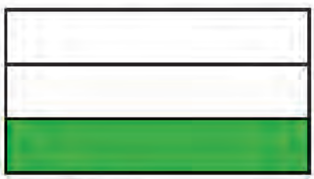
(a)  $\frac{2}{3}$

(b)  $\frac{1}{4}$

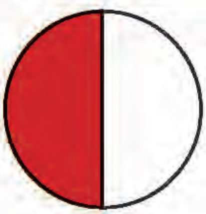
(c)  $\frac{5}{6}$

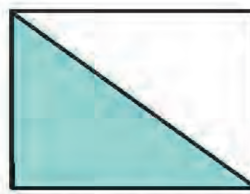
(d)  $\frac{2}{5}$

2. **Divide the given figure into two equal parts and write the coloured part formed from the figure into fraction:**

(a) 

(b) 

(c) 

(d) 

3. **Which number should be filled in the blank space? Write it:**

(a) $\frac{3}{7} = \frac{\square}{49}$ (b) $\frac{2}{9} = \frac{14}{\square}$ (c) $\frac{1}{5} = \frac{\square}{30}$ (d) $\frac{3}{11} = \frac{12}{\square}$

4. **Write the two equivalent fractions of the following given fraction:**

(a) $\frac{2}{5}$ (b) $\frac{1}{7}$ (c) $\frac{5}{8}$ (d) $\frac{4}{9}$

5. **Write an equivalent fraction having 16 in the denominator of each fraction given below:**

(a) $\frac{1}{2}$ (b) $\frac{3}{4}$ (c) $\frac{5}{8}$ (d) $\frac{1}{4}$

6. **Separate the equivalent fractions from the given fractions:**

(a) $\frac{1}{2}, \frac{2}{3}, \frac{2}{4}, \frac{6}{9}$ (b) $\frac{3}{4}, \frac{4}{7}, \frac{9}{12}, \frac{12}{21}$

7. **Fill the equivalent fraction in the blank space below:**

(a)

$\frac{4}{9} = \frac{4 \times 2}{9 \times 2} = \frac{8}{18}$

$\frac{4}{9} = \frac{4 \times 3}{9 \times 3} = \frac{\square}{\square}$

$\frac{4}{9}$

$\frac{4}{9} = \frac{4 \times 4}{9 \times 4} = \frac{\square}{\square}$

$\frac{4}{9} = \frac{4 \times 5}{9 \times 5} = \frac{\square}{\square}$

(b)

$\frac{2 \times 5}{3 \times 5} = \frac{\square}{\square}$

$\frac{2 \times 6}{3 \times 6} = \frac{\square}{\square}$

$\frac{2}{3}$

$\frac{2 \times 7}{3 \times 7} = \frac{\square}{\square}$

$\frac{2 \times 8}{3 \times 8} = \frac{\square}{\square}$

(c)

$\frac{1 \times 2}{3 \times 2} = \frac{\square}{\square}$

$\frac{1 \times 3}{3 \times 3} = \frac{\square}{\square}$

$\frac{1}{3}$

$\frac{1 \times 4}{3 \times 4} = \frac{\square}{\square}$

$\frac{1 \times 5}{3 \times 5} = \frac{\square}{\square}$

Project Work

Prepare an equivalent fraction chart of $\frac{1}{3}$ by using fraction strips.

Answer

Show the answer to your teacher.

4.2 Comparison of unlike fractions

Activity 1

Study the given figure below and discuss in the following questions:

(a) How is the coloured part expressed in fraction?

(b) How is the non coloured part expressed in fraction?

(c) Which of these two fractions is bigger?

In the coloured part $\frac{5}{7}$, there are 5 times of $\frac{1}{7}$ and in the non-coloured part $\frac{2}{7}$, there are 2, $\frac{1}{7}$ Since $5 > 2$, hence $\frac{5}{7} > \frac{2}{7}$.

If there are fractions having the same denominator, then the number of numerator should be compared. The greater, the numerator of the fraction is the greater the fraction.

4.2.1 Converting unlike fraction into like fraction

Activity 2

Study the figures given below and discuss in the following questions:

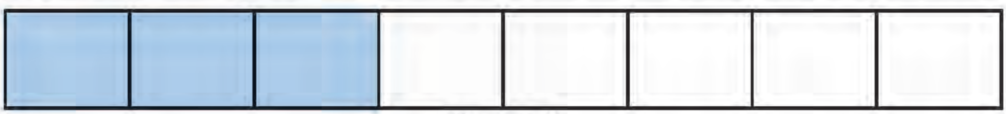


Figure I

Figure II

(a) How do the above figures write in fraction?

(b) Are the denominators of both the fractions equal?

(c) What should be done to make the unequal denominator to equal?

(d) In $\frac{3}{8}$ and $\frac{8}{16}$, which one is the greater?

Fraction of first figure is $\frac{3}{8}$ and that of second figure is $\frac{8}{16}$. The denominator of the fractions $\frac{3}{8}$ and $\frac{8}{16}$ are not equal. Fold the first figure into exactly two equal parts as shown in figure III. The first figure is divided into 16 parts. $\frac{3}{8}$ is called the equivalent fraction of $\frac{6}{16}$.

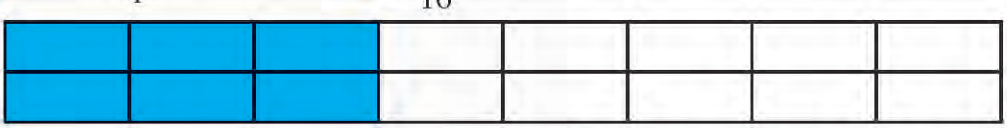


Figure III

Now, in $\frac{6}{16}$ and $\frac{8}{16}$, we can say that $\frac{8}{16}$ is the greater one.

In order to compare fractions with unequal denominators, the first of all denominator must be converted to the equal number.

Example 1

Convert $\frac{3}{5}$ and $\frac{5}{10}$ to the equal denominator:

Solution:

Making the equal denominator in $\frac{3}{5}$ and $\frac{5}{10}$.

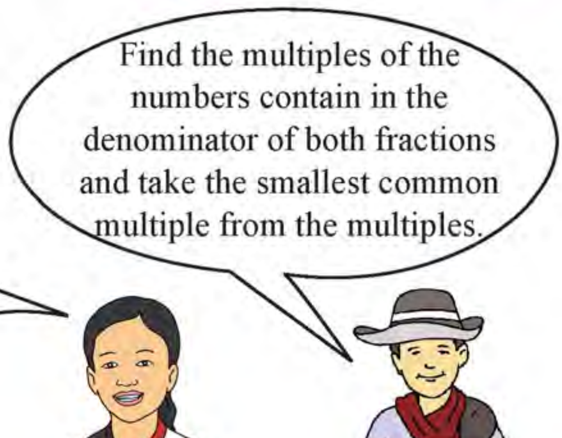
$$\frac{3}{5} = \frac{3 \times 2}{5 \times 2} = \frac{6}{10}$$

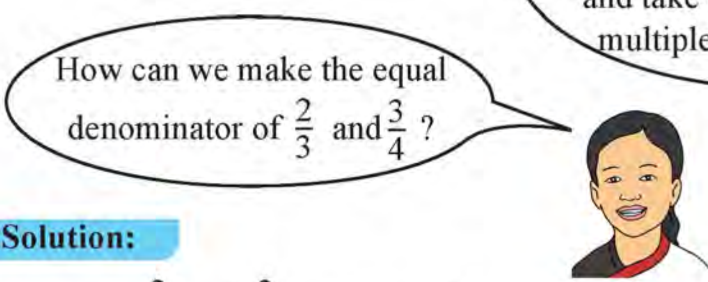
$\therefore$ $\frac{6}{10}$ and $\frac{5}{10}$ are the fractions having equal denominator.

To make denominator 5 of the first fraction as equal to denominator 10 of the second fraction, multiply the numerator and denominator both of the first fraction by 2.

Example 2

Convert $\frac{2}{3}$ and $\frac{3}{4}$ to the equal denominator:





Solution:

Converting $\frac{2}{3}$ and $\frac{3}{4}$ to the equal denominator,

Multiples of 3 are 3, 6, 9, 12, 15, …

Multiples of 4 are 4, 8, 12, 16, 20, …

The smallest common multiple of both 3 and 4 is 12.

So, the numerator and the denominator of $\frac{2}{3}$ should be multiplied by 4 and the numerator and denominator of $\frac{3}{4}$ should be multiplied by 3.

$$\frac{2}{3} = \frac{2 \times 4}{3 \times 4} = \frac{8}{12}$$

$$\frac{3}{4} = \frac{3 \times 3}{4 \times 3} = \frac{9}{12}$$

$\therefore$ $\frac{8}{12}$ and $\frac{9}{12}$ are the fractions with the equal denominator.

Example 3

In $\frac{2}{3}$ and $\frac{5}{6}$ which one is greater?

Solution:

Here, $\frac{2}{3}$ and $\frac{5}{6}$ are the fractions with unequal denominators.

Multiples of 3 are 3, 6, 9, 12, 15,...

Multiples of 6 are 6, 12, 18, 24,...

The smallest common multiple of both 3 and 6 is 6.

So,

$$\frac{2}{3} = \frac{2 \times 2}{3 \times 2} = \frac{4}{6}$$

$$\frac{5}{6} = \frac{5 \times 1}{6 \times 1} = \frac{5}{6}$$

To make the denominator 6 of $\frac{2}{3}$, multiply both numerator and denominator by 2.

Now, in $\frac{4}{6}$ and $\frac{5}{6}$ the denominator is equal. So, we compare their numerator.

Here, $5 > 4$, hence $\frac{5}{6} > \frac{4}{6}$

$\therefore \frac{5}{6} > \frac{2}{3}$

Hence, $\frac{5}{6}$ is a grater fraction.

Exercise 4.2

1. **Convert the given pair of fractions to a fraction having the equal denominator:**

   (a) $\frac{3}{4}$ and $\frac{1}{5}$ (b) $\frac{5}{7}$ and $\frac{3}{5}$ (c) $\frac{4}{7}$ and $\frac{8}{9}$ (d) $\frac{1}{3}$ and $\frac{2}{5}$

2. **Fill in the blanks with the appropriate symbols '>' '<' and '=':**

   (a) $\frac{2}{3} \square \frac{3}{8}$ (b) $\frac{2}{7} \square \frac{3}{5}$ (c) $\frac{2}{9} \square \frac{5}{8}$ (d) $3\frac{1}{3} \square \frac{10}{3}$

3. **Identify the larger fraction in the following pair fractions:**

   (a) $\frac{5}{6}$ and $\frac{7}{8}$ (b) $\frac{9}{7}$ and $\frac{5}{6}$ (c) $\frac{3}{8}$ and $\frac{9}{20}$ (d) $\frac{2}{3}$ and $\frac{3}{4}$

4. **Write the given fractions in ascending order:**

   $\frac{4}{5}$, $\frac{3}{4}$, $\frac{9}{10}$

5. **Deepa ate $\frac{2}{3}$ parts of bread and Dipesh ate $\frac{5}{7}$ parts of same size of bread. Who ate more bread? Find out.**

6. **If $\frac{2}{3}$ parts of a pole are painted black and $\frac{7}{8}$ parts are painted white, which coloured part of the pole is more? Find out.**

7. **If Ramila spends $\frac{2}{7}$ parts of her income on food and $\frac{5}{9}$ parts on education, under what heading has she spent less? Find out.**

8. **If Rupak ate $\frac{1}{3}$ parts of a cake in the morning and $\frac{3}{5}$ parts of the same cake in the evening, at what time did he eat less cake? Find out.**

Project work:

Convert the fractions $\frac{3}{5}$ and $\frac{5}{10}$ to the equal denominator by using a fraction strip and present them in the classrooms.

Answer:

Show the answer of 1 to 4 to your teacher.

5. Dipesh 6.White 7.In food 8.In the morning

4.3 Addition and subtraction of unlike fractions

Activity 1

What is the sum of $\frac{1}{2}$ and $\frac{2}{5}$. Find it by using fraction strip and present the conclusion.

Here, the smallest common multiple of 2 and 5 is 10.

So,

Step I: Cut three strips of 10cm x 2 cm from a chart paper.

Step II: Divide the first strip into two equal parts with the help of scale. Each part indicates $\frac{1}{2}$. We need $\frac{1}{2}$ part, so cut out one part. Colour the rest part.

$\frac{1}{2}$	$\frac{1}{2}$

Divide the second strip into five equal parts with the help of scale. Each part indicates $\frac{1}{5}$.

$\frac{1}{5}$	$\frac{1}{5}$	$\frac{1}{5}$	$\frac{1}{5}$	$\frac{1}{5}$

We need $\frac{2}{5}$ part, so cut out 3 parts. Colour the rest part.

Divide the third strip into 10 equal parts with the help of scale. Each part indicates $\frac{1}{10}$.

$\frac{1}{10}$	$\frac{1}{10}$	$\frac{1}{10}$	$\frac{1}{10}$	$\frac{1}{10}$	$\frac{1}{10}$	$\frac{1}{10}$	$\frac{1}{10}$	$\frac{1}{10}$	$\frac{1}{10}$

Step III: Place $\frac{1}{2}$ part (one part) from the first strip and $\frac{2}{5}$ part (two parts) from the second strip on the top of the third strip.

$\frac{1}{2}$					$\frac{1}{5}$		$\frac{1}{5}$		
$\frac{1}{10}$	$\frac{1}{10}$	$\frac{1}{10}$	$\frac{1}{10}$	$\frac{1}{10}$	$\frac{1}{10}$	$\frac{1}{10}$	$\frac{1}{10}$	$\frac{1}{10}$	$\frac{1}{10}$

Step IV: How many parts of the third strips are equal to the part of the strips placed above it. Count it.

Here, 9 parts out of 10 parts of the third strip are equal to the coloured parts.

So, $\frac{1}{2} + \frac{2}{5} = \frac{9}{10}$

Example 1

Add:

$$\frac{9}{10} + \frac{1}{6}$$

Solution:

Multiples of 10 = 10, 20, 30, 40, 50, 60, ...

Multiples of 6 = 6, 12, 18, 24, 30, 36,...................

The smallest common multiple = 30

$$\frac{9}{10} = \frac{9 \times 3}{10 \times 3} = \frac{27}{30}$$

$$\frac{1}{6} = \frac{1 \times 5}{6 \times 5} = \frac{5}{30}$$

Since the smallest common multiple is 30. So, the denominator of both fractions must be made 30.

Now,

$$\frac{9}{10} + \frac{1}{6}$$

$$= \frac{27}{30} + \frac{5}{30}$$

$$= \frac{27 + 5}{30}$$

$$= \frac{32}{30}$$

$$= \frac{16}{15}$$ (writing in lowest term)

Another method:

Solution:

Here, $\frac{9}{10} + \frac{1}{6}$

The denominators of both fractions are unequal. So, the denominator should be equal.

$$\left.\begin{aligned} 10 &= 2 \times 5 \\ 6 &= 2 \times 3 \end{aligned}\right| \begin{aligned} &\times 3 \\ &\times 5 \end{aligned}$$

Now, $\frac{9}{10} + \frac{1}{6}$

$$= \frac{9 \times 3}{10 \times 3} + \frac{1 \times 5}{6 \times 5}$$

$$= \frac{27}{30} + \frac{5}{30}$$

$$= \frac{27 + 5}{30}$$

$$= \frac{32}{30}$$

$$= \frac{16}{15}$$

Example 2

Subtract: $\frac{11}{24} - \frac{3}{8}$

Solution:

Multiples of 24 are 24,48, … Multiples of 8 are 8, 16, 24, 32, 40, … The smallest common multiple = 24 $\frac{11}{24} = \frac{11 \times 1}{24 \times 1} = \frac{11}{24}$ $\frac{3}{8} = \frac{3 \times 3}{8 \times 3} = \frac{9}{24}$	Next method The denominators of the fractions both fractions are unequal. So, the denominator should be equal. $\left.\begin{aligned} 24 &= 2 \times 2 \times 2 \times 3 \\ 8 &= 2 \times 2 \times 2 \end{aligned}\right| \times 3$ Now, $\frac{11}{24} - \frac{3}{8}$

Now, $\frac{11}{24} - \frac{3}{8}$ $= \frac{11}{24} - \frac{9}{24}$ $= \frac{11 - 9}{24}$ $= \frac{2}{24}$ $= \frac{1}{12}$	$= \frac{11}{24} - \frac{3 \times 3}{8 \times 3}$ $= \frac{11}{24} - \frac{9}{24}$ $= \frac{11 - 9}{24}$ $= \frac{2}{24}$ $= \frac{1}{12}$

Exercise 4.3

1 Calculate:

(a) $\frac{3}{4} + \frac{5}{6}$ (b) $\frac{2}{5} + \frac{1}{3}$ (c) $4\frac{1}{7} + 2\frac{3}{4}$

(d) $\frac{5}{9} + \frac{1}{3}$ (e) $1\frac{1}{10} + 9\frac{1}{5}$ (f) $\frac{11}{15} - \frac{3}{10}$

(g) $\frac{17}{2} - \frac{27}{4}$ (h) $3\frac{1}{5} - 2\frac{1}{10}$ (i) $\frac{5}{6} - \frac{5}{12}$

(j) $8\frac{2}{9} - \frac{1}{4}$

2. **If Vinita gave $\frac{1}{5}$ part of apples from $\frac{3}{4}$ part of apples to Hari, how many apples did Vinita has left now? Find out.**

3. **If the distance from first place A to B is $\frac{81}{4}$ m., and the distance from point B to C is $\frac{31}{2}$ m., what is the total distance from A to C? Find out.**

4. **The sum of the two fractions is $6\frac{1}{3}$. If the first fraction is $2\frac{1}{3}$, what is the second fraction? Find out.**

5. **Prasun divides an apple into 8 equal parts. Out of which $\frac{3}{8}$ part is eaten by Prasun and $\frac{1}{4}$ part is eaten by Pranjal. How many parts of apple did they eat together? Find out.**

6. Aditya has bought $5\frac{5}{6}$ kg of sweets on his birthday. If he distributes $1\frac{2}{3}$ kg sweets to his family members and $3\frac{1}{3}$ kg sweets to his friends, how much sweets will be left with him? Find out.

Project Work:

How can you add $\frac{1}{2}$ and $\frac{1}{3}$ by using fraction strips? Show it.

Answer:

1. (a) $1\frac{7}{12}$ (b) $\frac{11}{15}$ (c) $6\frac{25}{28}$ (d) $\frac{8}{9}$ (e) $10\frac{3}{10}$

   (f) $\frac{13}{30}$ (g) $1\frac{3}{4}$ (h) $1\frac{1}{10}$ (i) $\frac{5}{12}$ (j) $7\frac{35}{36}$

2. $\frac{11}{20}$ 3. $35\frac{3}{4}$ 4. $3\frac{5}{6}$ 5. $\frac{5}{8}$ 6. $\frac{5}{6}$ kg

4.4 Multiplication of Fractions

4.4.1 Multiplication of a fraction and a whole number

Example 1

1 litre of colour is sufficient to colour $\frac{3}{5}$m². How much m² can be coloured from 4 litres of colour.

Solution:

When writing it in a mathematical sentence,

$\frac{3}{5} \times 4$

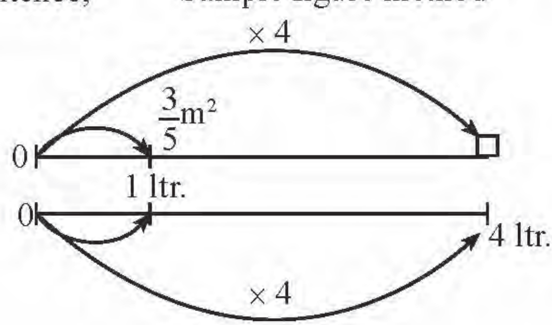
$= 4$ times $\frac{3}{5}$

$= 4 \times 3$ times $\frac{1}{5}$

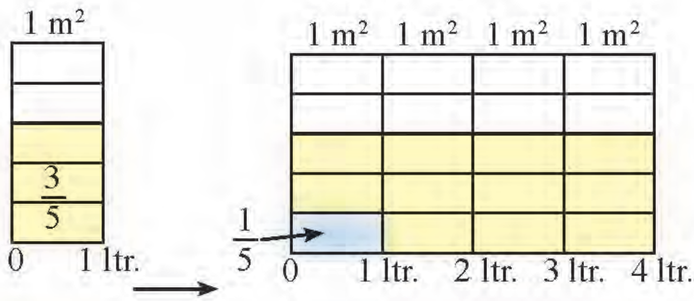
$= 12$ times $\frac{1}{5}$

$= \frac{12}{5}$m²

Sample figure method



Sample figure method



4 times $\frac{3}{5}$

$= (4 \times 3)$ times $\frac{1}{5}$

$= 12$ times $\frac{1}{5}$

$= \frac{12}{5} m^2$

When any fraction is multiplied by a whole number, the number in the numerator of the fraction must be multiplied by the whole number.

Example 2

Multiply: $5 \times \frac{3}{5}$

Solution:

Here, $5 \times \frac{3}{5}$

$= \frac{5 \times 3}{5}$

$= 3$

Example 3

What is $\frac{7}{8}$ part of 56?

Solution:

Here, $56 \times \frac{7}{8}$

$= \frac{56 \times 7}{8}$

$= 49$

Example 4

Shashikala had 6 oranges. She gave $\frac{1}{3}$ part of 6 oranges to Bishnu. How many oranges did she give ?

Solution:

There are 6 oranges in the figure. There is $\frac{1}{3}$ part given to Bishnu. $\frac{1}{3}$ means 1 part of 3 parts, So, when divided into three parts,

There are 2 oranges in each part. Since she gave 1 part to Bishnu, she gave only two oranges.

The number of oranges with Shashikala = 6

Given to Bishnu = $\frac{1}{3}$ part

The number of oranges given to Bishnu = ?

Now, the oranges given to Bishnu

$= \frac{1}{3}$ part of 6

$= 6 \times \frac{1}{3}$

$= \frac{6 \times 1}{3}$

$= 2$

Exercise 4.4.1

1. **If 1 box of tiles can cover $\frac{3}{10}$ part of the roof of a house, how much parts of the roof of the house will be covered by 3 boxes of tiles?**
2. **Stones are paved in the park. If 1 truck of stones is required to pave $\frac{2}{15}$ part of the park, how much part of the park will be paved by 6 truck of stones?**
3. **Find the product:**

   (a) $\frac{2}{3} \times 12$ (b) $\frac{3}{8} \times 15$ (c) $\frac{1}{3} \times 25$ (d) $\frac{1}{9} \times 27$
4. **Find the value:**

   (a) $\frac{3}{4}$ part of 2 kg (b) $\frac{5}{4}$ part of 100 cm

   (c) $\frac{2}{3}$ part of 1 year (d) $\frac{3}{4}$ part of 200 students
5. **Calculate:**

   (a) What is $\frac{1}{5}$ part of 25?

(b) What is $\frac{3}{4}$ part of 120?

6. **Ramvilas has lent $\frac{3}{5}$ part of Rs. 1000 to Harikant,**

   (a) how much amount has Ramvilas lent to Harikant?

   (b) how much money will left with Ramvilas? Find out.

7. **If $\frac{1}{5}$ part of rice is taken out from a sack of rice containing 25 kg. How much kg. of rice is taken out from the sack? How much kg. of rice is left in the sack?**

8. **The road from Dumre to Chandravati is 18 km long. If $\frac{2}{3}$ km of the road is blacktop? How many km. of the road is left to be blacktop?**

Answer

Show the answer of 1 to 3 to your teacher.

4. (a) 1500 gm. (b) 125 cm. (c) 8 months (d) 150 students

5. (a) 5 (b) 90

6. (a) Rs.600 (b) Rs.400

7. 5 kg., 20 kg.

8. The part of road with blacktop = 12 km., Remaining part = 6 km.

4.4.2 Multiplication of fraction by a fraction

Example 1

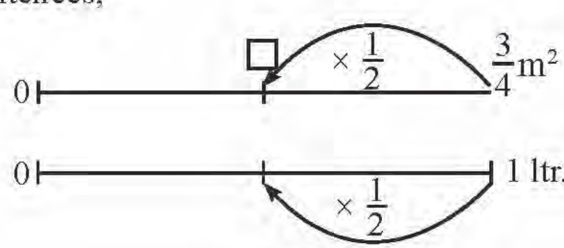
If 1 litre of colour is enough to colour $\frac{3}{4}$ m², how many m² will $\frac{1}{2}$ litre colour enough to colour?

Solution:

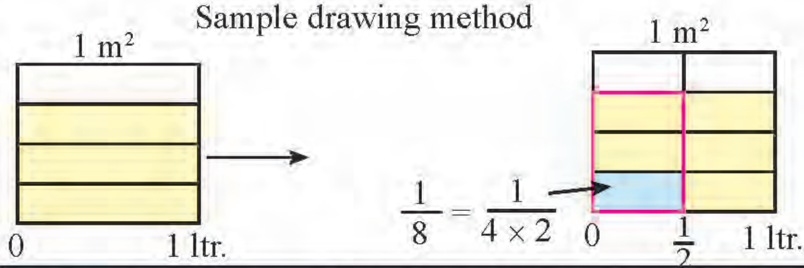
When writing it in mathematical sentences,

It is enough to colour in $\frac{3}{4} \times \frac{1}{2} m^2$

$= \frac{3 \times 1}{4 \times 2} m^2 = \frac{3}{8} m^2$



Sample drawing method



$\frac{1}{8} = \frac{1}{4 \times 2}$

$\frac{1}{8}$ part of 3

$= \frac{3}{8}$

When a fraction is multiplied by a fraction, the product after multiplying the numerator by the numerator is placed in the numerator. Then, the product after multiplying the denominator by the denominator is placed in the denominator to make a new fraction.

Example 2

Multiply: $\frac{3}{5} \times \frac{5}{6}$

Solution:

Here, $\frac{3}{5} \times \frac{5}{6} = \frac{3 \times 5}{5 \times 6} = \frac{3}{6} = \frac{1}{2}$

Example 3

Find the value: $\frac{3}{4}$ **Part of** $\frac{1}{2}$ **kg.**

Solution:

Here, $\frac{3}{4}$ part of $\frac{1}{2}$kg.

$= \frac{1}{2}\text{kg} \times \frac{3}{4}$

$= \left(\frac{1 \times 3}{2 \times 4}\right)\text{kg} = \left(\frac{3}{8}\right)\text{kg}$

$= \frac{3}{8} \times 1000$ gm [So, 1 kg = 1000 gm]

= 375 gm

Exercise 4.4.2

1. **Find the product:**

(a) $\frac{4}{5} \times \frac{3}{8}$ (b) $\frac{1}{5} \times \frac{1}{3}$ (c) $2\frac{1}{7} \times 2\frac{4}{9}$

2. **Khados wants to paste coloured paper on the wall of his room. One packet of paper is enough to pest $\frac{3}{4}$m², how many m² will half packet**

of paper enough to paste?

3. What is the total weight of $5\frac{1}{2}$ watermelon if the weight of one watermelon is $6\frac{2}{3}$ kg.?

4. If $2\frac{1}{5}$ litres of petrol is required for one hour journey in a car, how many litres of petrol is required for $5\frac{2}{5}$ hours journey?

5. A glass was contained $\frac{3}{4}$ parts of milk. If Raju drank $\frac{2}{3}$ part of that milk then

   (i) how much part of milk did he drink?

   (ii) how much part of milk is left in the glass now?

Project Work

Find the product of the fractions $\frac{3}{4}$ and $\frac{2}{3}$ by folding a rectangular paper and present it in the classroom:

Answer

1. (a) $\frac{3}{10}$ (b) $\frac{1}{15}$ (c) $5\frac{5}{21}$ 2. $\frac{3}{8}$ m^2

3. $36\frac{2}{3}$ kg 4. $11\frac{22}{25}$ 5. (i) $\frac{1}{2}$ glass (ii) $\frac{1}{4}$ glass

4.5 Division of fractions

4.5.1 Division of fraction by whole number

Example 1

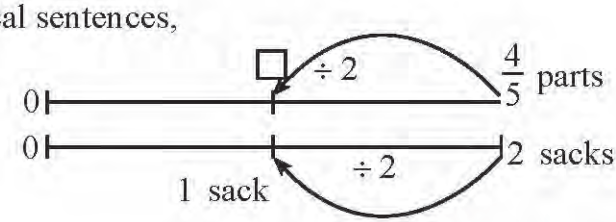
2 sacks of fertilizer are required for $\frac{4}{5}$ parts of farmer's field, how much part of that field can be covered by 1 sack of fertilizer ?

Solution:

When writing it in mathematical sentences,

$$\frac{4}{5} \div 2$$

$$= (\frac{4}{5} \times \frac{1}{2}) \div (2 \times \frac{1}{2})$$



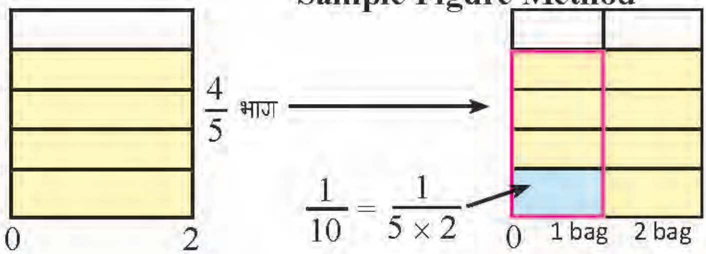
$= \frac{4}{5 \times 2} \div 1$

$= \frac{4}{5 \times 2}$

$= \frac{4}{10}$

$= \frac{2}{5}$

Sample Figure Method



4 times $\frac{1}{5 \times 2}$

$= \frac{4}{5 \times 2}$

$= \frac{4}{10}$

$= \frac{2}{5}$

When a fraction is divided by a whole number, the sign of division (÷) is changing into the sign of multiplication (×) and the divisor should be reciprocal.

Example 2

Divide: $\frac{1}{3} \div 2$

Solution:

Here, $\frac{1}{3} \div 2 = (\frac{1}{3} \times \frac{1}{2}) \div (2 \times \frac{1}{2})$

$= \frac{1}{3 \times 2} \div 1$

$= \frac{1}{6}$

Next Method,

$\frac{1}{3} \div 2$

$= \frac{1}{3} \times \frac{1}{2}$

$= \frac{1}{3 \times 2}$

$= \frac{1}{6}$

Division sign is changing into multiplication sign and divisor should be reciprocal.

Example 3

Divide: $1\frac{2}{5} \div 6$

Solution:

Here, $1\frac{2}{5} \div 6 = \frac{7}{5} \div 6$

$= \frac{7}{5} \times \frac{1}{6}$

$= \frac{7 \times 1}{5 \times 6}$

$= \frac{7}{30}$

Division sign is changing into multiplication sign and divisor should be reciprocal.

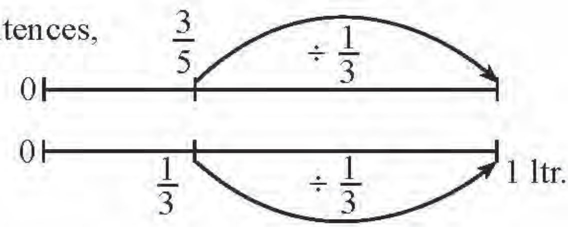
4.5.2 Division of a fraction by another fraction

Example 1

If $\frac{1}{3}$ litre colour is needed to colour $\frac{3}{5}$ part of a door, how many part of the door is coloured by 1 litre colour?

Solution:

When writing it in mathematical sentences,



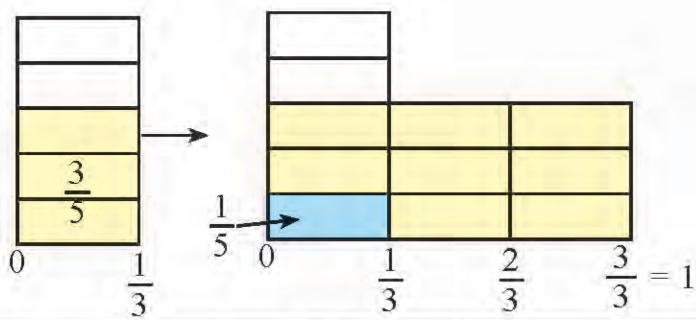
$$\frac{3}{5} \div \frac{1}{3}$$

$$= \frac{3}{5} \times \frac{3}{1} \div \frac{1}{3} \times \frac{3}{1}$$

$$= \frac{3 \times 3}{5 \times 1} \div 1$$

$$= \frac{9}{5}$$

Sample Figure Method



$\frac{3}{5}$ parts 3

$\frac{1}{5}$ parts 3×3

$= \frac{1}{5}$ parts 9

$= \frac{9}{5}$

When one fraction is divided by another fraction, the sign of division ($\div$) is changed into the sign of multiplication ($\times$) and the divisor fraction should be reciprocal.

Example 2

Find the quotient: $3\frac{5}{9} \div 2\frac{2}{3}$

Solution:

$$3\frac{5}{9} \div 2\frac{2}{3}$$

$$= \frac{32}{9} \div \frac{8}{3}$$

$= \frac{32}{9} \times \frac{3}{8}$

To make $\frac{8}{3}$ into $\frac{3}{8}$ and multiply by $\frac{32}{5}$

$= \frac{4}{3}$

$= 1\frac{1}{3}$

Example 3

Divide: $6 \div 1\frac{1}{5}$

Solution:

Here, $6 \div 1\frac{1}{5} = 6 \div \frac{6}{5} \quad = 6 \times \frac{5}{6}$

$= 5$

Example 4

Mohan bought 3 litres colour to paint the doors of the house. If it takes $\frac{3}{4}$ part of one litre of colour to paint a door, how many doors would be painted with 3 liters of colour? Find out.

Solution:

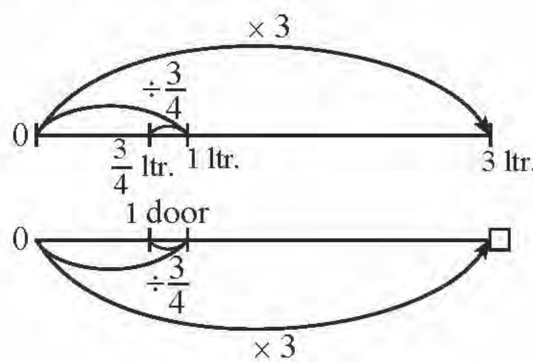
When writing the above problem in mathematical sentences,

$\left(1 \div \frac{3}{4}\right) \times 3$

$= \left(1 \times \frac{4}{3}\right) \times 3$

$= \frac{4}{3} \times 3$

$= 4$



Exercise 4.5

1. **Divide:**

(a) $\frac{1}{3} \div 5$ (b) $\frac{1}{4} \div 3$ (c) $\frac{1}{2} \div 10$ (d) $\frac{2}{5} \div 12$

(e) $20 \div \frac{4}{7}$ (f) $4 \div \frac{1}{2}$ (g) $8 \div \frac{2}{3}$ (h) $5 \div \frac{3}{5}$

2. **Calculate:**

(a) $\frac{18}{13} \div \frac{9}{8}$ (b) $\frac{32}{7} \div \frac{16}{7}$ (c) $3\frac{5}{7} \div 2\frac{5}{7}$ (d) $4\frac{4}{5} \div 2\frac{2}{15}$

3. **Santosh called 15 people to dig up the land for vegetable cultivation. If they could dig only $\frac{3}{4}$ part in 1 day, how many parts of the land could one people dig? Find it.**

4. **Toll Reform Committee wants to pave bricks on the road of the toll. If $\frac{1}{3}$ part of bricks of a truck can be paved on $\frac{2}{7}$ part of the road, how many parts of the road can be paved with the bricks of a truck? Find out.**

5. **How many pieces will be made in total from a long rope of length 25 meter where the length of a piece is $\frac{5}{6}$ meter long? Find it.**

6. **If $\frac{3}{4}$ meter curtain is required for a small window, in how many windows can be put curtains from a 30 meter long cloth banal? Find it.**

7. **How many bottles can be filled with 20 litres of milk such as the capacity of each bottle is $1\frac{1}{4}$ litre? Find out.**

8. **How many containers of the same capacity can be filled by filling 41 $\frac{1}{2}$ litres of oil such as the capacity of a container is $\frac{1}{2}$ litre? Find out.**

9. **What is the product when the value obtained after subtracting $\frac{2}{5}$ from $3\frac{1}{2}$ is divided by $\frac{1}{2}$ is multiplied by $1\frac{1}{2}$? Find out.**

Answer

1. (a) $\frac{1}{15}$ (b) $\frac{1}{12}$ (c) $\frac{1}{20}$ (d) $\frac{1}{30}$

(e) 35 (f) 8 (g) 12 (h) $\frac{25}{3}$

2. (a) $1\frac{3}{13}$ (b) 2 (c) $1\frac{7}{19}$ (d) $\frac{9}{4}$

3. $\frac{1}{20}$ 4. $\frac{6}{7}$ 5. 30 6. 40

7. 16 8. 83 9. $9\frac{3}{10}$

Lesson 5

Decimal

5.0 Review

Find the sum and difference of the pairs of fraction and decimal given below.

(a) 0.34 and $\frac{23}{100}$ (b) 2.55 and $\frac{42}{100}$ (c) 3.75 and $\frac{212}{100}$ (d) 23.97 and $\frac{1237}{1000}$

Can we add or subtract all the above mentioned fractions and decimals? What do we need to add or subtract them? Discuss in your peer group.

Both decimal and decimal fraction should be transferred to the same pattern: decimal or decimal fraction to add or to subtract.

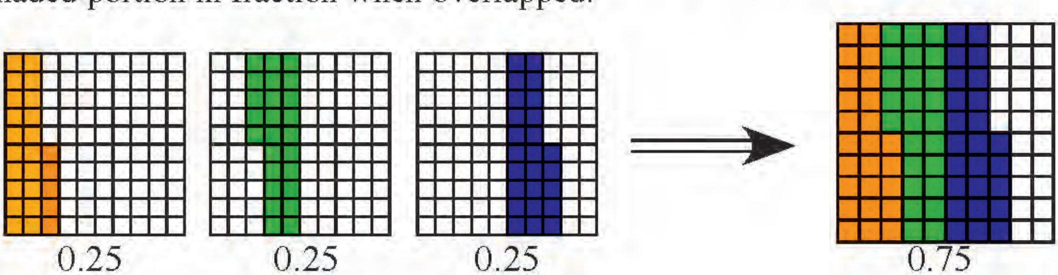
5.1 Multiplication of decimal numbers

5.1.1 Multiplication of decimal number by a whole number

Activity 1

Use a transparent paper to show the multiplication of 0.25 by the whole number 3.

Take three pieces of transparent paper of the same size and shade 0.25 part in each piece as shown in the figure. Now, overlap all three pieces. Write the shaded portion in fraction when overlapped.



Expressing multiplication in the form of repeated addition,

$0.25 \times 3 = 0.25 + 0.25 + 0.25 = 0.75$

Therefore, $0.25 \times 3 = 0.75$

While multiplying decimal number by a whole number, multiply without considering decimal point at first. Count the total digits after decimal point in the given decimal number. Then, put the decimal point in the product at the place of digits from right to the left. Decimal point is given after two digits from right in 0.25×3. So, decimal point is given after two digits from right in its product 0.75.

Example 1

Multiply: 2.45 × 5

Solution

Here,

Multiplying 2.45 by 5,

$$\begin{array}{r} 2.45 \\ \times 5 \\ \hline 12.25 \end{array}$$

Therefore, $2.45 \times 5 = 12.25$

Example 2

If the length of a square handkerchief is 0.62 meter, find its perimeter.

Solution

Here, length of a square handkerchief (l) = 0.62 meter

Perimeter of a square handkerchief (P) =?

We know that,

$$\begin{array}{r} 2 \\ 0.62 \\ \times 4 \\ \hline 2.48 \end{array}$$

Perimeter of a square (P) = 4 l = 4×0.62 meter

Hence, perimeter of a handkerchief (P) = 2.48 meter

5.1.2 Multiplication of decimal numbers

Activity 1

Take two decimal numbers 0.25 and 0.2. Write their fractions.

$$\frac{25}{100} \times \frac{2}{10}$$

$$= \frac{50}{1000}$$

$$= 0.05$$

Now, $0.25 \times 0.2 = 0.05$

(a) Multiply in the same way as whole numbers are multiplied. Ignore decimal point.
Example: $25 \times 2 = 50$

(b) Count the total digits after decimal point in both decimal numbers. Then, put the decimal point in the product at the place of the digits from right to left.

Example: There altogether three digits after decimal point in both numbers. Therefore, product 0.050 = 0.05

Example 3

Multiply: 0.6 × 2.47

Solution:

Here, $6 \times 247 = 1482$

Therefore, $0.6 \times 2.47 = 1.482$

2.47	(2 digits after decimal point)
×0.6	(1 digit after decimal point)
1.482	(3 digits after decimal point)

Example 4

The length and breadth of a rectangular path inside a garden are 37.7 meter and 2.8 meter respectively. What is the area of the path? Find it.

Solution:

Here, length of the path (l) = 37.7 m

Breadth of the path (b) = 2.8 m

We know that,

Area (A) = l × b

= 37.7 × 2.8 m

= 105.56 m²

$$\begin{array}{r} 37.7 \\ \times\ 2.8 \\ \hline 3016 \\ +754 \\ \hline 105.56 \end{array}$$

Hence, area of path (A) = 105.56 m²

> Following rules can be applied for multiplication of decimal numbers by 10 or powers of 10.
>
> 10 × 0.6284 = 6.284 (while multiplying by 10, the decimal point is shifted 1 digit right)
>
> 100 × 0.6284 = 62.84 (while multiplying by 100, the decimal point is shifted 2 digits right)
>
> 1,000 × 0.6284 = 628.4 (while multiplying by 1,000, the decimal point is shifted 3 digits right)
>
> 10,000 × 0.6284 = 6,284 (while multiplying by 10,000, the decimal point is shifted 4 digits right)
>
> 1,00,000 × 0.6284 = 62,840 (while multiplying by 1,00,000, the decimal point is shifted 5 digits right)

Exercise 5.1

1. Convert the following fractions into decimal numbers:

(a) $\frac{3}{10}$ (b) $\frac{34}{100}$ (c) $\frac{713}{1000}$ (d) $\frac{191}{100}$ (e) $\frac{3471}{100}$

2. Multiply:

(a) 2×2.51 (b) 5×1.25 (c) 4×12.67 (d) 7×0.923

(e) 9×9.9 (f) 10×8.297 (g) 100×0.657 (h) 21×0.21

(i) 101.03 × 2.35 (j) 232.01 × 4.2 (k) 183.31 × 3.1

(l) 530.12 × 1.52 (m) 986.41 × 1.02 (n) 555.76 × 5.05

3. **Solve the following questions:**

a. Anjila has 3 red pencils. Each pencil is 3.25 inches in length. What is the total length of all the three pencils?

b. If the length of a square field is 8.45 meter, find its perimeter.

c. What is the perimeter of a rectangular garden with the length 7.25 meter and breadth 5.13 meter? Calculate.

d. If the cost of a ruler is Rs. 25.50, what is the total cost of 10 such rulers? Calculate.

Answers

1.	(a)	0.3	(b)	0.34	(c)	0.713	(d)	1.91	(e)	34.71
2.	(a)	5.02	(b)	6.25	(c)	50.28	(d)	6.46	(e)	89.10
	(f)	82.97	(g)	65.70	(h)	4.41	(i)	237.42	(j)	974.44
	(k)	568.26	(q)	805.78	(m)	1006.14	(n)	2806.59		
4.	(a)	11.25 in	(b)	31.8 m	(c)	24.76 m			(d)	Rs. 255

5.2 Division of the decimal number

Activity 1

The weight of 12 refrigerators is 1229.4 kilograms. If the weight of all the refrigerators is equal, what is the weight of one refrigerator? Which mathematical operation should be applied to solve this problem? Discuss.

$$
\begin{array}{r}
102.45 \\
12\overline{)1229.4} \\
-12 \\
\hline
29 \\
-24 \\
\hline
54 \\
-48 \\
\hline
60 \\
-60 \\
\hline
0
\end{array}
$$

The weight of 1 refrigerator is 102.45 kg.

To check division,

We can do this:

Divisor × Quotient = Dividend

Example 1

17.40 ÷ 4

Solution:

4) 17.40 (4.35
-16
14
-12
20
-20
0

a. First, divide a whole number by a whole number. Then, shift down 4 which is to the right of the decimal point and put decimal point in the quotient.

b. Divide 14 by 4 and write quotient after decimal point.

c. Put 0 immediately after 2 which is the difference of 14 and 12 and divide 20 by 4.

Alternative method,

17.40 ÷ 4
= (17.40 × 100) ÷ (4 × 100)
= 1740 ÷ 400
= 4.35

400) 1740 (4.35
-1600
1400
-1200
2000
- 2000
0

Example 2

Divide: 149.04 ÷ 12

Solution:

Here, 149.04 ÷ 12

12) 149.04 (12.42
-12
29
-24
50
- 48
24
- 24
0

Therefore, 149.04 ÷ 12 = 12.42

Example 3

Divide: 0.5850 ÷ 18

Solution:

Here, 0.5850 ÷ 18

$$
\begin{array}{r|l}
18 & 0.5850 \,(\, 0.0325 \\
 & -54 \\ \hline
 & \;\;45 \\
 & -36 \\ \hline
 & \;\;\;90 \\
 & -90 \\ \hline
 & \;\;\;\;0
\end{array}
$$

(a) Since there is no digit before decimal point. Put 0 and decimal point in the quotient.

(b) Since 5 is not divisible by 18, put 0 after decimal point in the quotient and take 58.

Therefore, 0.5850 ÷ 18 = 0.325

Note: The following rules can be applied for the division of decimal numbers by 10 or powers of 10.
232.59 ÷ 10 = 23.259 (while dividing by 10, the decimal point is shifted 1 digit left)
232.59 ÷ 100 = 2.3259 (while dividing by 100, the decimal point is shifted 2 digits left)
232.59 ÷ 1000 = 0.23259 (while dividing by 1000, the decimal point is shifted 3 digits left)
232.59 ÷ 10000 = 0.023259 (while dividing by 10000, the decimal point is shifted 4 digits left)

Exercise 5.2

1. Divide:

(a) 183.31 ÷ 10 (b) 288.012 ÷ 12 (c) 121.77 ÷ 11

(d) 530.1 ÷ 100 (e) 966.45 ÷ 15 (f) 557.825 ÷ 25

2. Solve the following problems:

a. If a man travels 7.5 km in 10 minutes on a bike, how much distance will he travel in one minute? Find it.

b. If the perimeter of a square shaped field is 48.64 m, find the length of the field.

c. If the area of a rectangular field is 248.64 m^2 and its length is 16m, find its breadth.

d. If the cost of a cauliflower weighing 2.85 kg is Rs. 171, what wil be the cost of 1 kg of cauliflower? Find it.

Answers

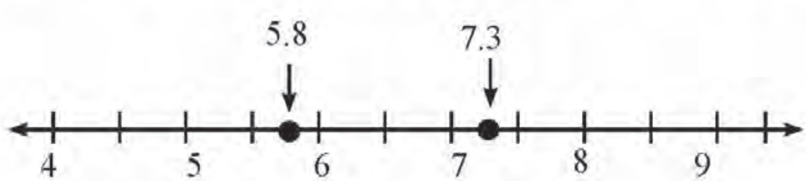
1. (a) 18.33 (b) 24 (c) 11.07 (d) 5.30 (e) 64.43 (f) 22.31
2. (a) 0.75 km (b) 12.16 m (c) 15.54 m (d) Rs. 60

5.3 Rounding off of decimal numbers

Activity 1

Write the length of these two pencils in cm.

The length of the first pencil is 5.8 cm and the length of the second pencil is 7.3 cm. The former 5.8 cm is nearer to the whole number 6 whereas the second 7.3 is nearer to the whole number 7. Therefore, we can say that the pencils are approximately 6 cm and 7 cm long. This is called rounding off of decimal number. Because 5.8 lies between 5 and 6, it is more nearer to 6 than 5. Similarly, 7.3 lies between 7 and 8, it is more nearer to 7 than 8.



Therefore, we write off 5.8 cm ≈ 6 cm, 7.3 cm ≈ 7cm in rounding off numbers.

The ways of expressing any quantity to the nearest convenient position is called rounding off. Example: 23.67 ≈ 23.70

Method of rounding off

(a) If the digit which is to be rounded off is less than 5, make it 0.
Example: rounding off 3.573 to 3 decimal place is written as 3.570.
Therefore, $3.573 \approx 3.570$

(b) If the digit which is to be rounded off is 5 or greater than 5, we consider this digit to be 0 and 1 is added to the digit in the previous (left) place.
Example: rounding off 92.637 to 3 decimal place is written as 92.640.
Therefore, $92.637 \approx 92.640$

Example 1

Round off the following numbers to (a) third (b) second and (c) first decimal place:

(1) 7.563 (2) 67.328

Solution:

1. Here, 7.563

(a) 3 lies in the third place of decimal, since $3 < 5$. So, $7.563 \approx 7.560$

(b) 6 lies in the second place of decimal, since $6 > 5$. So, $7.563 \approx 7.60$

(c) 5 lies in the first place of decimal, since $5 = 5$. So, $7.563 \approx 8.0$

2. Here, 67.328

(a) 8 lies in the third place of decimal, since $8 > 5$. So, $67.328 \approx 67.330$

(b) 2 lies in the second place of decimal, since $2 < 5$. So, $67.328 \approx 67.30$

(c) 3 lies in the first place of decimal, since $3 < 5$. So, $67.328 \approx 67.0$

Exercise 5.3

1. **Round off the following numbers to third, second and first decimal places:**

(i) 5.6342 (ii) 23.472 (iii) 45.736 (iv) 78.862

(v) 0.917 (vi) 36.727 (vii) 104.983 (viii) 0.8624

2. **Solve the following problems:**

   (a) If the cost of an article weighted in the digital balance is shown Rs. 346.72, how much money has to be paid? Calculate.

   (b) If the volume of a cubical tank is 345.543 ft^3,

      (i) what is its volume in whole number?

      (ii) round off its volume to second decimal place.

   (c) If the total cost of 4 garlands of marigold is Rs. 275, how much will one garland cost? Round off to one decimal place.

3. (a) Measure the length of your sign pen, pencil and bench in cm.

   (b) Divide the length of bench by the length of pencil.

   (c) Round off the length of bench and length of pencil to whole number.

   (d) Divide the length of bench by the rounded off length of pencil.

   (e) Compare the results of (b) and (d).

   (f) Present the above work with figure.

Answers

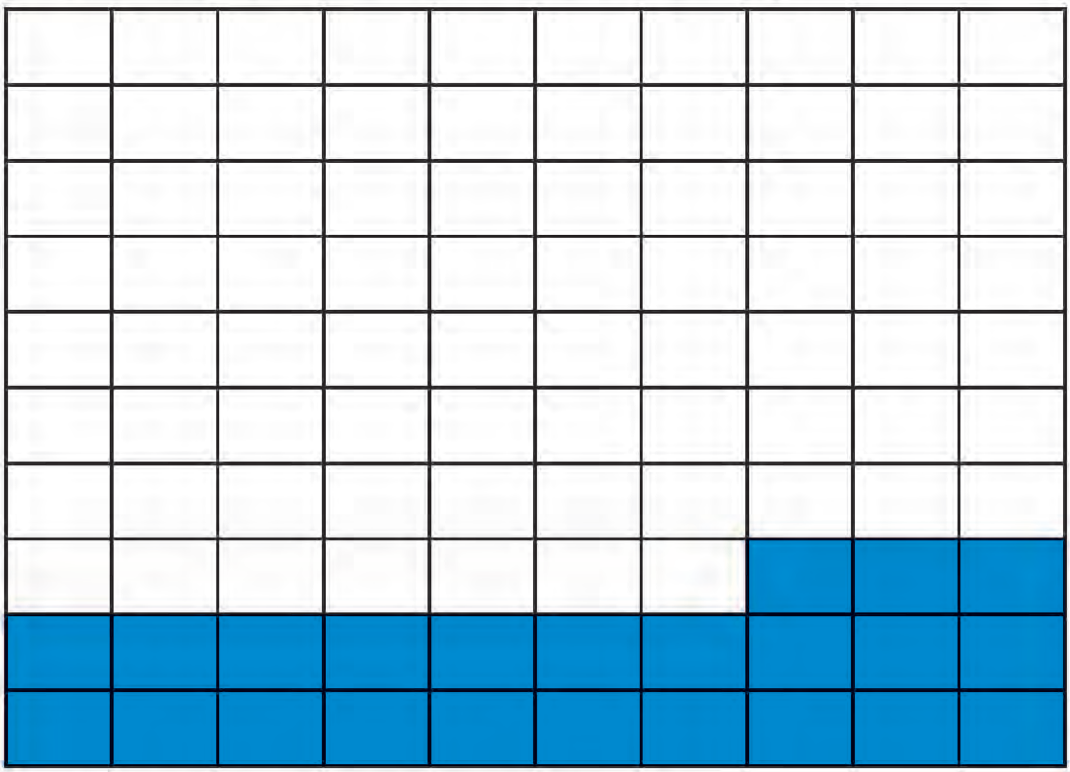
Show the answers to your teacher.

Lesson 6

Percentage

6.0 Review

Observe the figure below and discuss the following questions:



(a) How many boxes are there in the rectangle?

(b) How many boxes are coloured ?

(c) Write the fraction to represent the coloured portion.

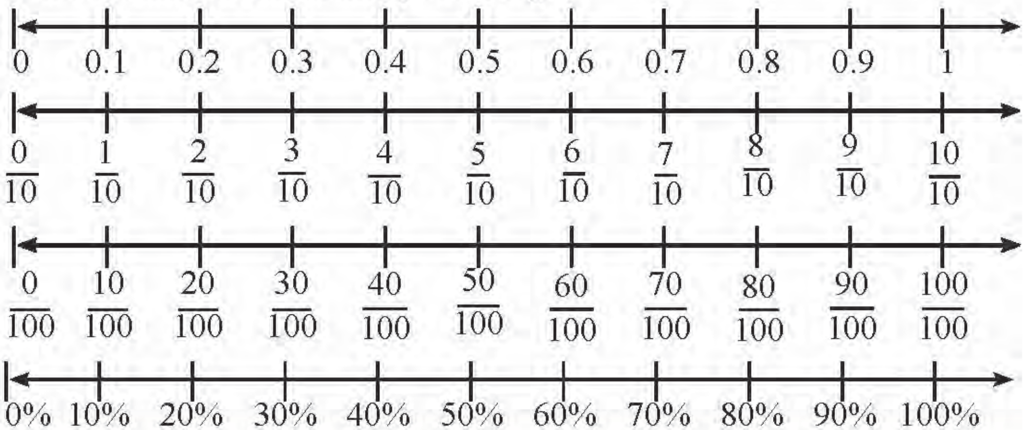
(d) What is the decimal number to represent the coloured portion?

Numerator of the fraction represents the percentage value of the fraction having denominator 100. Percentage is denoted by '%' symbol.

6.1 Relationship between fraction, decimal and percentage

Activity 1

Observe the number lines given below and discuss the relationship between fraction, decimal and percentage:



While converting fraction or decimal into percentage it should be multiplied by 100 and the symbol '%' should used.
While converting percentage into fraction it should be divided by 100 and the symbol '%' should be removed.

Example 1

Write $\frac{2}{5}$ in percentage.

Solution

First method,

$$\frac{2}{5} = \frac{2 \times 100}{5 \times 100} = \frac{40}{100} = 40\%$$

Second method,

$$\frac{2}{5} = \frac{2 \times 20}{5 \times 20} = \frac{40}{100} = 40\%$$

Here, the numerator and denominator of $\frac{2}{5}$ is multiplied by 20 to make the denominator 100.

Third method,

Here, $\frac{2}{5}$ means,

2 parts out of 5 parts

$\therefore$ 2/5 parts out of 1 part

$\therefore$ out of 100 parts = 2/5 × 100 = 40 parts

$\therefore$ 2/5 = 40%

Example 2

Convert 8% into fraction and express it into the lowest term.

Solution:

$$8\% = \frac{8}{100} = \frac{2\times2\times2}{25\times2\times2} = \frac{2}{25}$$

8% means, 8 parts out of 100 parts.

6.2 Problems related to percentage

Activity 2

Study the given condition and discuss on the questions and conclude. In Himalayan secondary school, there are 50 students in class 6. If 60% are girls,

(a) How many students are girls?

(b) How many students are boys?

(c) What percentage of students are boys?

Solution:

Total number of students = 50

Total percentage = 100%

(a) Number of girls = 60% of 50

$= 50 \times \frac{60}{100}$

$= 30$

(b) Number of boys = Total number of students – Number of girl students

= 50 - 30

= 20

(C) Percentage of boys $= \frac{20}{50} \times 100\%$

$= 40\%$

Model drawing method

Girls	Boys
60%	40%

(a) Number of girls

= 60% of 50

$= \frac{60}{100}$ parts of 50 = 30

(b) Percentage of boys

= 100% - 60% = 40%

(c) Number of boys

= 50 -30

= 20

Example 3

How much is 75% of Rs. 120?

Solution:

75% of Rs. 120

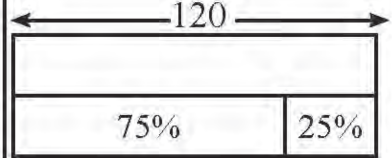
$= \text{Rs. } 120 \times \frac{75}{100}$

$= \text{Rs. } \frac{9000}{100}$

$= \text{Rs. } 90$

$\therefore$ 75% of Rs. 120 is Rs. 90.

Model drawing method



$120 \times \frac{75}{100}$

$= 90$

Example 4

There were 50 students in class 6. If 8 students were absent, what percentage of students were absent? What percentage of students were present?

Solution:

Total number of students = 50

Number of absent students = 8

Percentage of absent students =?

Number of present students = 50 – 8 = 42

Now,

Percentage of absent students

$= \frac{8}{50} \times 100\%$

$= 8 \times 2\%$

$= 16\%$

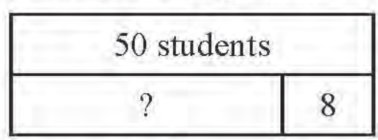
Percentage of present students

$= \frac{42}{50} \times 100\%$

$= 42 \times 2\%$

$= 84\%$

Model drawing method



Percentage of absent students

$= \frac{8}{50} \times 100\%$

$= 16\%$

Percentage of present students

$= \frac{42}{50} \times 100\%$

$= 84\%$

Exercise 6

1. **State whether the following statements are true (√) or false (×).**

   (a) 25% is 25 parts out of 100 parts.

   (b) $\frac{3}{4}$ in percentage is written as 25%.

   (c) Lowest term of 0.45% is to be written as $\frac{9}{20}$.

   (d) While converting fraction or decimal into percentage, divided by 100 and we should use the symbol %.

2. **Convert each of the following percentage into fraction and convert them into the lowest term.**

   (a) 22% (b) 57% (c) 63% (d) 1.5% (e) 0.5%

3. **Convert the following fractions and decimals into percentage.**

   (a) $\frac{2}{5}$ (b) $\frac{3}{20}$ (c) 0.45 (d) 1.8 (e) 0.03

4. **Find the value in the following conditions.**

   (a) How much is 85% of Rs. 400?

   (b) How much is 20% of Rs. 1500?

   (c) How much is 25% of 1000 l?

   (d) How much is 15% of 2 km?

   (e) How much is 75% of 1280 m?

5. **If 200 students like to play football out of 500 students,**

   (a) What is the percentage of students who like to play football?

   (b) What is the percentage of students who do not like to play football?

(6) **If 500 m of a 2 km road is blacktopped, what percentage of road is blacktopped?**

(7) **800 students of a school have participated in different games in "a sports week" of a school. If 20% has received gold medal, 30% has received silver medal and 35% has received bronze medal,**

   (a) How many students have received gold medal?

   (b) How many students have received silver medal?

   (c) How many students have received bronze medal?

Project work

Note down the class wise number of girls, number of boys and total number of students at your school. Calculate the percentage of girls and boys of each class and present it in the classroom.

Answers

Show the answers from 1 to 3 to your teacher.

4. (a) Rs. 340 (b) Rs. 300 (c) 250l (d) 300 m (e) 960
5. (a) 60% (b) 40%
6. 25%
7. (a) 160 (b) 240 (c) 280 (d) 15%

Lesson 7

Profit and Loss

7.0 Review

Selling price of a football with similar shape and size in two different shops are shown in the table. Study and discuss to answer the questions:

Shop A	Shop B
 Price – Rs. 2000	 Price – Rs. 1875

(a) How much is the cost of football in shop A?

(b) How much is the cost of football in shop B?

(c) Which shop's price is dearer?

(d) Which shop's price is cheaper? How much is it cheaper by?

(e) From which shop will you prefer to buy the football? Why?

7.1 Introduction to profit and loss

Activity 1

Study the given condition and draw the conclusion after discussing the given questions.

Harkman does the business of bags. He has bought some bags from wholesale shop at the rate of Rs. 700 per bag. He has sold one of the bags to Lakpa in Rs. 900. Similarly, he has sold another bag to Raju at

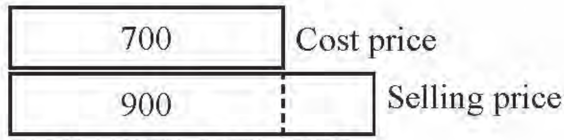
Rs. 650 because it got discoloured.

(a) Did he earn profit or lose from the selling of the first bag?

(b) What was his profit or loss from second bag? By how much?

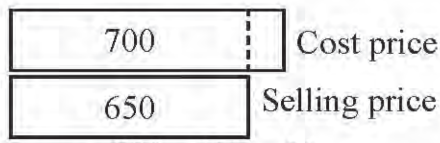
(c) How much was the total profit or loss by selling both bags?

Harkman has sold the bag at Rs. 900 to Lakpa which was brought at Rs. 700. He bought it at lower price but sold it at higher price. So there is a profit of Rs. 200.



Profit = 900 - 700 = 200

Likewise, Harkman has made the loss of Rs. 50 by the selling of the bag to Raju because he bought the bag at higher price but sold it at lower price.



Loss = 700 - 650 = 50

Total cost price of two bags = Rs. 700 + Rs. 700

= Rs.1400

Total selling price of two bags = Rs. 900 + Rs. 650

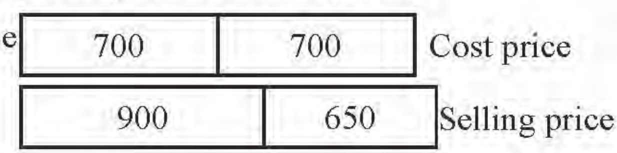
= Rs. 1550

Since selling price is more than the cost price, there is a profit.

Profit = Selling price – Cost price

= Rs. 1550 – 1400

= Rs. 150



Profit = 1550 – 1400 = 150

∴ Total profit by the selling of the two bags is Rs. 150.

The price at which something is bought called cost price. The price at which something is sold called selling price. If selling price is more than the cost price, there is a profit whereas if selling price is less than cost price, there is a loss.

Therefore,

If S.P. (Selling Price) > C.P. (Cost Profit), there is a profit.

Profit = S.P. (Selling Price) – C.P. (Cost Profit)

If S.P. (Selling Price) < C.P. (Cost Profit), there is a loss.

Loss = C.P. (Cost Profit) – S.P. (Selling Price)

Example 1

Ramesh Chaudhary bought a refrigerator for Rs. 18,500 and sold it at Rs. 22,000, what was his profit or loss? Calculate.

Solution

Cost price of the refrigerator (C.P.) = Rs. 18, 500

Selling price of the refrigerator (S.P.) = Rs. 22,000

Selling price is more than the cost price.

Therefore, there is profit.

Now, profit = S.P. – C.P.

= Rs. 22,000 – Rs. 18,500

= Rs. 3,500

∴ Ramesh made profit of Rs. 3,500.

C.P.	18,500
S.P.	22,000

S.P. > C.P., therefore there was profit.

Profit = 22,000 – 18,500 = 3,500

Example 2

Anisha sold a jacket at Rs. 2500 and she got a profit of Rs. 200, what was the cost price of the jacket? Find it.

Solution

S.P. of the jacket = Rs. 2500

Amount of profit = Rs. 200

C.P. of jacket = ?

We know that,

Cost price = Selling price – Profit

= Rs. 2500 – Rs. 200

= Rs. 2300

S.P.		2,500
C.P.	200	

C.P. + 200 = 2,500

C.P. = 2,500 - 200 = रु. 2,300

∴ Anisha bought a jacket at Rs. 2300.

Example 3

Bishal sold an old model mobile set at the loss of Rs. 2,000 which had been bought for at Rs. 24,500. What was the selling price of the mobile set? Find it.

Solution

Cost price of the mobile set = Rs. 24,500

Loss = Rs. 2,000

Selling price of mobile set =?

We know that,

S.P. = C.P. – Loss

= Rs. 24500 – 2000

= Rs. 22500

24,500		c.p.
S.P.	2000	

S.P. + 2,000 = 24,500

S.P. = 24,500 - 2,000 = Rs. 22,500

∴ Bishal sold the mobile set at Rs. 22,500.

Exercise 7

1. **State whether the following statements are true (√) or false (×).**
   (a) If the selling price of an article is higher than the cost price, there is a profit.
   (b) When profit is added to the selling price, it gives the cost price.
   (c) If selling price is less than the cost price, there is a loss.
   (d) If selling price is higher than the cost price, there is a loss.
   (e) If the selling price of an article is less than the cost price, there is a profit.
2. **How much is profit or loss in the following cases? Find it.**

Item	Cost price	Selling price
Watch	Rs. 7000	Rs. 7720
Mobile	Rs. 9000	Rs. 8750
Bicycle	Rs. 5000	Rs. 2750
bag	Rs. 2650	Rs. 2900

3. Harinarayan bought a laptop for Rs. 65,000 and sold it at Rs. 50,000. What was his profit or loss? Find it.
4. Ravi bought a calculator for Rs. 2050 and sold it to Anisha by making the profit of Rs. 200. What was the selling price of the calculator?
5. Sabina sold a sari for Rs. 3500 and made the profit of Rs. 650, what was the cost price of the sari? Calculate.
6. Dhruba bought a pen drive for Rs. 1000 and sold it to Surendra by making the profit of Rs. 250. Surendra sold it to Basu by making the loss of Rs. 300.
   (a) What was the selling price of the pen drive for Dhruba?
   (b) What was the cost price of the pen drive for Basu?
7. Rambilas bought 5 kg of oranges for Rs. 120 per kg and sold it at Rs. 150 per kg. What was his profit or loss? Calculate.
8. A shopkeeper bought 10 pens for Rs. 75 each and he sold all the pens at Rs. 80 each. How much was his profit or loss? Calculate.
9. Ramesh bought a wooden cupboard for Rs. 18,550. He sold it at Rs. 14,200 due to his transfer in job to an other place. How much was his profit or loss? Calculate.

Project work

Visit some shops nearby your school or home; collect the price of any seven items you consume daily. Which shops are cheaper and which are dearer? Find it and present in your classroom.

Answers

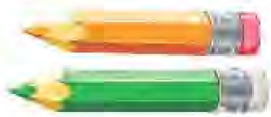
1. Show to your teacher.
2. (a) Profit Rs. 720 (b) Loss Rs. 250 (c) Loss Rs. 2250 (d) Profit Rs. 250
3. Loss Rs. 15000 4. S.P. Rs. 2250 5. C.P. Rs. 2850
6. (a) Rs. 1250 (b) Rs. 950
7. Profit Rs. 150
8. Profit Rs. 50
9. Loss Rs. 4350

Lesson 8

Unitary Method

8.0 Review

If Krishna, Santosh and Khados buy 1, 2 and 3 pencils respectively for Rs. 10 per pencil, how much will each of them have to pay to the shopkeeper? Discuss.

Pencil	Price Rs.
	10 Or $10 \times 1 = 10$ Krishna will have to pay Rs. 10.
	$10 + 10 = 20$ Or $10 \times 2 = 20$ Santosh will have to pay Rs. 20.
	$10 + 10 + 10 = 30$ Or $10 \times 3 = 30$ Khados will have to pay Rs. 30.

Here, the price of 2 pencils means the price of one pencil is to be added twice and the price of 3 pencils means the price of one pencil is to be added thrice. To find the price of two pencils, the price of one pencil is multiplied by 2. Similarly, to find the price of three pencils, the price of one pencil is multiplied by 3.

When the price of one item is known. The price of the item is to be multiplied by the number of the same item to find out the price of more items.

8.1 Problems related to unit cost and total cost

Activity 1

Study the bill given below and discuss the questons:

Bill No. – 025

Our Grocery Shop
Balkhu, Kathmandu

Date: 2076/11/25

Customer's name: Suntali Lama

S.N.	Particulars	Quantity	Rate	Price
1.	Sugar	3 kg	Rs. 80	Rs. 240
2.	Flour	5 kg	Rs. 45	Rs. 225
Total				Rs 465
In words: Four hundred sixty five only.				

Seller : Saroj

(a) How much is the cost of 1 kg of sugar?

(b) Why does 3 kg of sugar cost Rs. 240?

(c) How much is the cost of 5 kg of flour?

(d) Why does 1 kg of flour cost Rs. 40?

(e) What does the rate in the bill mean?

In the above bill,

(a) The cost of 1 kg of sugar is Rs. 80.

(b) The cost of 3 kg of sugar = Rs. 80×3 = Rs. 240

(c) Similarly, the cost of 5 kg of flour is Rs. 225.

(d) The cost of 1 kg of flour = Rs. $\frac{225}{2}$ or Rs. $225 \div 5$ = Rs. 45

(e) Rate in the bill means the unit cost of an item.

(a) When the price of one item is known. The price of the item is to be multiplied by the number of the same item to find out the price of more items-

Total cost = Unit value of on item × Number of the item

(b) When the total cost of on items is divided by the number of the items, we get unit cost of an item.

$$\text{Unit value} = \frac{\text{Total value}}{\text{Number of items}}$$

Example 1

If the cost of a copy is Rs. 50, how much will 6 copies cost?

Solution:

Cost of 1 copy = Rs. 50

Cost of 6 copies = Rs. 50 × 6

= Rs. 300

∴ Total cost of 6 copies is Rs. 300.

To find the value of more quantities, multiply the unit cost by the number of quantities.

Example 2

If the cost of 20 kg of rice is Rs. 2500, how much will 1 kg of rice cost?

Solution:

Cost of 20 kg of rice = Rs. 2500

Cost of 1 kg of rice = Rs. $\frac{2500}{20}$

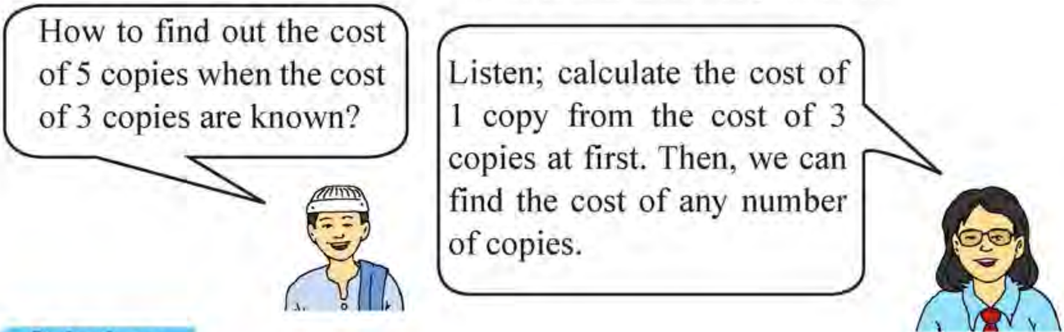
= Rs. 125

∴ Cost of 1 kg rice is Rs. 125

To find the unit cost of an article, the total cost of articles is to be divided by the number of articles.

Example 3

If the cost of 3 copies is Rs. 270, how much will 5 copies cost?



Solution:

Cost of 3 copies = Rs. 270

Cost of 1 copy = Rs. $\frac{270}{3}$ = Rs. 90

Cost of 5 copies = Rs. 90 × 5 = Rs. 450

Exercise 8.1

1. **State whether the following statements are true (√) or false (×).**
   (a) To find the cost of more items, the unit cost is to be divided by the number of the item.
   (b) To find the unit cost of an item, the total cost of items is to divided by the number of items.
   (c) If the cost of 5 geometry boxes is Rs. 600, the cost of one geometry box is 120.
   (d) If the cost of one pencil is Rs. 10, the cost of one dozen pencil is Rs. 100.
   (e) Total cost = Unit cost of the item × Number of the items

2. **Find the total cost in the condition of given below:**

	Number of items	Unit cost
(a)	23	Rs. 75
(b)	2	Rs. 950
(c)	55	Rs. 45

3. **Find out the unit cost in the condition of given below:**

	Number of items	Total cost
(a)	325	Rs. 2925
(b)	25	Rs. 600
(c)	17	Rs. 1145

4. **If the cost of a football is Rs. 1275, how much will 4 footballs cost? Calculate.**

5. **If the monthly salary of an employee is Rs. 35,000. How much will his yearly salary be?**

6. **Sabina bought one dozen of exercise book for Rs. 45 per copy. How much will she have to pay in total? Calculate.**

7. **if the price of a packet of chocolates containing 100 chocolates is Rs. 500, what is the price of 1 chocolate? Calculate.**

8. **Ram has paid Rs. 600 to buy 5 dozen of bananas. If he had bought only one dozen of banana, how much would he have to pay? Calculate.**

9. **Mina bought 60 notebooks for Rs. 6000. If she bought only one dozen. How much would she have to pay? Calculate.**

10. **If the total cost of 100 entrance tickets of a park is Rs. 3600, what will the cost of one entrance ticket? Calculate.**

11. **Complete the table on the basis of given price:**

	Cost of 2 articles	Unit cost	Cost of 5 articles	Cost of 8 articles
(a)	Rs. 16			
(b)	Rs. 150			
(c)	Rs. 1000			

12. **If the cost of 6 cricket balls is Rs. 900, what will be the cost of 4 cricket balls? Calculate.**

13. **If the cost of 3 bags is Rs. 1275, what will be the cost of 5 bags? Calculate.**

14. **If the cost of 25 kg of rice is Rs. 2250, how much will 60 kg of rice cost? Calculate.**

15. **If the cost of 10 l of petrol is Rs. 1100, how much does 5l of petrol cost? Calculate.**

Project work

Visit a shopkeeper nearby and ask with the shopkeeper and prepare a list of unit cost of any 6 items of the shop. On the basis of the list, calculate the cost of 10 items of each item and share it to the class.

Answers

Show 1 to 3 to your teacher.

4.	Rs. 5,100	5.	Rs. 4,20,000	6.	Rs. 1,140	7.	Rs. 5
8.	Rs. 120	9.	Rs. 1,200	10.	Rs. 36		

11. Show to your teacher.

12.	Rs. 600	13.	Rs. 2,875	14.	Rs. 5,400	7.	Rs. 480

Miscellaneous exercise

1. **If a hare jumps 2/2 feet at a time from a certain place and another hare jumps 3/3 feet at a time from the same place, find the answers of these questions:**

   (a) Write the distance travelled in each jump from the initial position by the first hare.

   (b) Write the distance travelled in each jump from the initial position by the second hare.

   (c) Write at least three positions of numbers where both hares stand simultaneously.

(d) Which position of number represents the first meet of both hares? What is the representation of that position? Write.

2. **Ram has 6 chocolates. He has decided to distribute all the chocolates equally among all without keeping any for him.**

   (a) How many people can be distributed those chocolates in different way? In which ways and to how many people can be distribute the chocolates?

   (b) What do these numbers represent? Write.

3. **Find the prime factors of 30 and 105 and write the answers of following questions,**

   (a) What are the common factors of the numbers?

   (b) What are the remaining factors?

   (c) Find the product of common and remaining factors. What is the result? Write conclusion.

4. **A contractor won a contract of two roads for blacktopping. 3/4 part of the first road of 36 km was blacktopped in one month and 2/3 part of the second road of 60 km was blacktopped in the same time.**

   (a) How many kilometers of road was blacktopped in total?

   (b) Which road had more blacktopped? By what quantity? Calculate.

5. **Suman earns Rs. 32500 a month. He spends 1/2 of his income on household expenses. Similarly, he spends 1/4 part of his income on clothing and deposits the remaining to a bank.**

   (a) How much is spent on household expenses?

   (b) How much is spent on clothing? Find in percentage too.

6. **Ramila obtained 20 out of 25 in English and 30 out of 40 in Science.**

   (a) Find the marks obtained in both subjects in percentage.

   (b) Which subject is she better of? By what precentage? Calculate.

7. **Raman has bought 6 pens for Rs. 450.**

   (a) What is the price of one pen?

   (b) How many pens of the same rate can be purchased at Rs. 675?

(c) If he makes a profit of Rs. 150 by selling 6 pens, what is the selling price?

8. Purnaman bought 400 eggs for Rs. 4000 from a wholesaler and spent Rs. 300 on transportation. 50 of the eggs fell and brokes.

(a) What was the total cost of 400 eggs?

(b) If remaining eggs were sold at Rs. 13 per egg, how much profit or loss did he make? Calculate.

(c) At what rate should the remaining eggs be sold to make a profit of Rs. 600 in total? Calculate.

9. Haribahadur is a businessman. He buys two watches from a wholesale shop of an equal price for Rs. 6500 in total.

(a) How much is the price of 1 watch?

(b) If he sells the first watch of Rs. 3500. How much profit or loss did he make from the first watch? Calculate.

(c) At what price should the second watch be sold to make a profit of Rs. 600 in total?

10. How many cans of equal capacity will be needed to pour 170*l* of milk in the can with the capacity of 8.5*l*?

11. If a rope of 34.48m in length is divided to 8 equal parts,

(a) What will be the length of each pieces?

(b) Seema took away 3 pieces of rope. How many metres of rope did she take away? Calculate.

Unit-Three | Mensuration

Lesson 9

Distance

9.0 Review

Discuss the following questions:

(a) What is the length and breadth of your Mathematics book; the length, breadth and height of the desk and distance between office of school and classroom?

(b) Which units will you use to find the distance or the length in the above condition?

(c) What is the relationship among millimeter (mm), centimeter (cm), meter (m) and kilometer (km)?

10 millimeter (mm) = 1 centimeter (cm)

100 centimeter (cm) = 1 meter (m)

1000 meter (m) = 1 kilometer (km)

The length between any two points is called distance. Various units are used to measure the distance between any two points. Generally, mm, cm, foot (ft) and m are used to measure short distance whereas km, mile etc. are used to measure long distance.

9.1 Relationship between inch and centimeter

1 inch (in) = 2.54 centimeter (cm)

9.2 Relationship among inch, foot and centimeter

Activity 1

Measure the distance from the units: one wall to another wall of the classroom with a measuring tape in foot (ft), centimeter (cm), meter (m) and inch (in) respectively and compare the values obtained in different units. Example: Compare the value of distance measured in cm with the values of distance measured in ft, m and inch.

Discuss the relationship among ft, cm, m and in and write the conclusion.

1 inch (in)	=	2.54 centimeter (cm)
1 foot (ft)	=	30.48 centimeter (cm)
1 meter (m)	=	39.37 inch (in)
1 meter (m)	=	3.28 foot (ft)
1 foot (ft)	=	12 inch (in)

Activity 2

Measure your friend's height in foot with a measuring tape. Convert the value into centimeter, meter and inch.

Height of the friend $= 4$ ft 6 in

$= 4 \text{ ft} + \frac{6}{12}$ ft (why is it divided?)

$= (4 + 0.5)$ ft.

$\therefore$ Height of the friend $= 4.5$ ft

(a) To convert into centimeter (cm),

Height of the friend $= 4.5$ ft

$= 30.48 \times 4.5$ cm (Why is it multiplied?)

$\therefore$ Height of the friend $= 137.16$ cm

(b) To convert into meter (m),

Height of the friend $= 4.5$ ft

$= 4.5 \div 3.28$ m (why is it divided?)

$\therefore$ Height of the friend $= 1.37$ m

(c) To convert into inch (in),

Height of friend $= 4.5$ ft

$= 12 \times 4.5$ in (Why is it multiplied?)

$\therefore$ Height of the friend $= 54$ in

Multiply to convert larger unit into smaller unit and divide to convert smaller unit into larger unit.

Example 1

Convert 5 m into cm, m, ft:

Solution:

Here, to convert into cm, $5 \text{ m} = 100 \times 5 \text{ cm} = 500 \text{ cm}$

To convert into in, $5 \text{ m} = 39.37 \times 5 \text{ in} = 196.85 \text{ in}$

To convert into ft, $5 \text{ m} = 3.28 \times 5 \text{ ft} = 16.4 \text{ ft}$

Example 2

If the Aayushma is 58 inch tall, what is her height in cm, ft and m? Calculate.

Solution:

Here, height of Aayushma $= 58 \text{ in} = 2.54 \times 58 \text{ cm} = 147.32 \text{ cm}$

Height of Aayushma $= 58 \text{ in} = \frac{58}{12} \text{ ft} = 4.83 \text{ ft}$

Height of Aayushma $= 58 \text{ in} = \frac{58}{39.37} \text{ m} = 1.47 \text{ m}$

Example 3

If the floor of a classroom is 480 cm long, what is its length in in, ft and m? Calculate.

Solution:

Here, length of classroom = 480 cm $= \frac{480}{2.54}$ in = 188.98 in

Length of classroom = 480 cm $= \frac{480}{30.48}$ ft = 15.75 ft

Length of classroom = 480 cm $= \frac{480}{100}$ m = 4.8 m

Example 4

If the length and breadth of a board in a classroom are 2 m 60 cm and 4 ft 8 in respectively, by what ft is the length greater than breadth? Calculate.

Solution:

Length of the board = 2 m 60 cm = 2m + $\frac{60}{100}$ m = 2m+0.6 m = 2.6 m

Calculating the length of the board in foot = 2.6 m = 3.28 × 2.6 ft

= 8.528 ft = 8.53 ft

Breadth of the board = 4 ft 8 in = 4 ft + $\frac{8}{12}$ ft = 4ft + 0.67 ft = 4.67 ft

Difference between length and breadth of the board = 8.53 ft - 4.67 ft = 3.86 ft

Therefore, the length of the board is greater by 3.86 ft than its breadth.

Exercise 9

1. **Complete these:**
   (a) 1 m = … cm
   (b) The length of 3 feet long the board is ..... in.
   (c) If you have walked 500 m to reach at your school then you have walked … feet.
   (d) If the length of a bench is 250 cm then the bench is ..... feet long.
   (e) If the length of the floor of a classroom is 500 cm thenit is ..... in long.
2. **Convert all the measurements given below into centimeter:**
   (a) 3m 60 cm (b) 6 ft (c) 8ft 6 in (d) 11 ft 10 in

3. **Convert all the measurements given below into inch:**

   (a) 7 m (b) 15 m 30 cm (c) 7 ft 8 in (d) 25 ft 6 in

4. **Convert all the measurements given below into feet:**

   (a) 9 m 40 cm (b) 14 m 25 cm (c) 46 m 75 cm (d) 32ft 8 in

5. **Convert all the measurements given below into meter:**

   (a) 24 m 80 cm (b) 53 ft (c) 44 ft 10 in (d)88 ft 6 in

6. **If the length and breadth of a field are 650 ft 10 in and 250 ft 8 in respectively. By what ft is the field longer than the breadth? Calculate.**
7. **If the length and breadth of a ground are 225 m 40 cm and 150 ft 8 in respectively. By what ft is the ground longer that the breadth? Calculate.**
8. **The length of a wall is 567 m 50 cm. If another 225 ft 10 in long wall is added to it. What is the total length of wall in m? Calculate.**
9. **A 4567m 20cm long road has to be constructed. If 789 ft 6 in of the road has been constructed by public contribution. How many feet of the road is yet to be constructed? Calculate.**

Project work

Prepare a list of your family members and find their heights in ft. Convert their heights into cm, m and inch respectively and present the report with conclusion in classroom.

Answers

1. (a) 100 cm (b) 36 in (c) 1640 ft (d) 8.2 ft (e) 188.98 in
2. (a) 360 cm (b) 182.88 cm (c) 259.08 cm (d) 360.68 cm
3. (a) 275.60 in (b) 602.36 in (c) 92 in (d) 306 in
4. (a) 30.83 ft (b) 46.74 ft (c) 153.34 ft (d) 32.67 ft
5. (a) 24.8 m (b) 16.19 m (c) 13.67 m (d) 24.54 m
6. 400.16 ft 7. 588.64 ft 8. 636.35 m 9. 14,190.92 ft

Lesson 10

Perimeter, Area and Volume

10.0 Review

Discuss the following questions:

(a) What is perimeter?

(b) How do you calculate the perimeter of the given photo frame?

(c) How do you calculate the surface area of the photo frame?

10.1 Perimeter of rectangle and square

Activity 1

Measure the length and breadth of the table of your classroom, what will be the perimeter of the surface of table? Calculate.

Length of the surface of the table (l) = 4 ft and

Breadth of the surface of the table (b) = 3 ft

Perimeter of the surface of the table (P) = Sum of the length of outer edges

$= 4 \text{ ft} + 3 \text{ ft} + 4 \text{ ft} + 3 \text{ ft}$

$= 4 \text{ ft} \times 2 + 3 \text{ ft} \times 2$

$= 2 (4 \text{ ft} + 3 \text{ ft})$

$= 2 \times 7 \text{ ft}$

$= 14 \text{ ft}$

Therefore, perimeter of the table = 14 ft.

The sum of the length of outer edges of an object is called its perimeter. Perimeter of a rectangular surface $(P) = 2$ (length + breadth). Symbolically, $P = 2(l + b)$

Similarly, perimeter of a square is $(P) = 2(l + b) = 2(l + l) = 4l$

Example 1

What will be the perimeter of the given rectangle? Calculate.

Solution:

Here,

Length of rectangle (l) = 6cm

Breadth of rectangle (b) = 4 cm

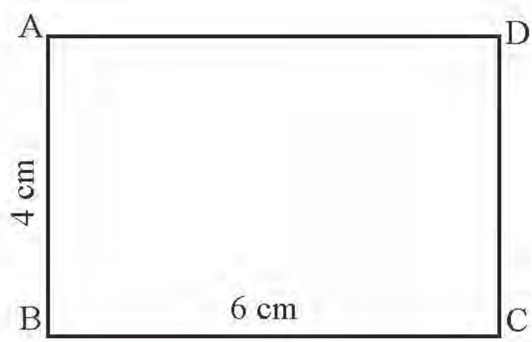
Perimeter of rectangle (P) = ?

Now, $P = 2(l + b)$

$= 2(6 + 4)$

$= 2 \times 10$

$= 20$ cm



Therefore, perimeter of rectangle (P) = 20 cm

Example 2

If the perimeter and breadth of a rectangle are 18 cm and 4 cm respectively, what will the length of the rectangle? Calculate.

Solution:

Here,

Perimeter of rectangle (P) = 18 cm

Breadth of rectangle (b) = 4cm

Length of rectangle (l) = ?

Now, $P = 2(l + b)$

or, $18 = 2(l + 4)$

or, $18 = 2l + 8$

or, $2l = 18 - 8$

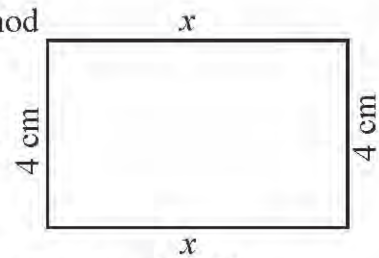
or, $2l = 10$

or, $l = \frac{10}{2}$

or, $l = 5$

$\therefore$ Length of rectangle (l) = 5 cm

Model drawing method



Here, $2x + 8 = 18$

or, $2x = 18 - 8 = 10$

or, $x = \frac{10}{2}$

or, $x = 5$

Example 3

If the perimeter of a square shaped handkerchief is 120 cm, what will be its length? Calculate.

Solution:

Here, perimeter of square shaped handkerchief (P) = 120 cm

Length of square shaped handkerchief (l) = ?

Here, $P = 4l$

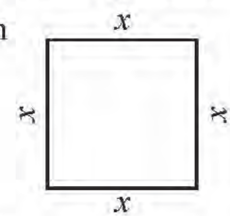
or, $120 = 4 \times l$

or, $l = \frac{120}{4} = 30$

or, $l = 30$

Therefore, length of square shaped handkerchief (l) = 30 cm.

Model drawing method



Here, $4x = 120$

or, $x = \frac{120}{4}$

or, $x = 30$

Exercise 10

1. **State whether the following statements are true or false.**

   (a) Perimeter of a rectangle is calculated by adding length and breadth.

   (b) Perimeter of a book having the length of 15 cm and the breadth of 10 cm is 50 cm.

   (c) Perimeter of a table having the length 6 m. and the breadth 2 m. is 12 m.

   (d) Perimeter of a rectangle having the length of 2 m. and the breadth of 1 m. is 6 m.

(e) Perimeter of a square is calculated, by multiplying its length by 4.

(f) Perimeter of a 5m long square shaped handkerchief 25 m.

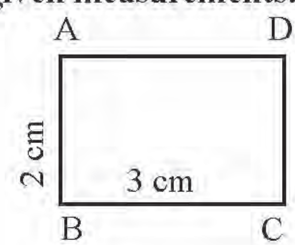
(g) The length of a square is 1 m if its perimeter is 4 m.

2. Find the perimeter of the following rectangles and squares with the given measurements:

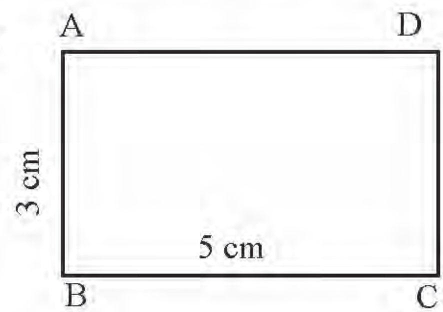
(a) AB = 8 cm	BC = 5 cm
(b) AB = 15 m	BC = 5 m
(c) PQ = 9 cm	QR = 6 cm
(d) XY = 12.5 ft	YZ = 7 ft
(e) AB = 28 cm	BC = 15 cm
(f) AB = 35 ft	BC = 35 ft
(g) QR = RS = 40 m	

3. Find the perimeter of the following rectangles and squares with the given measurements:

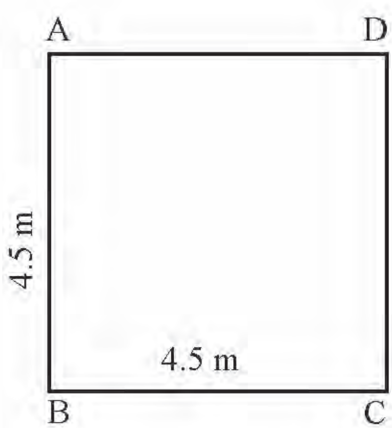
(a)



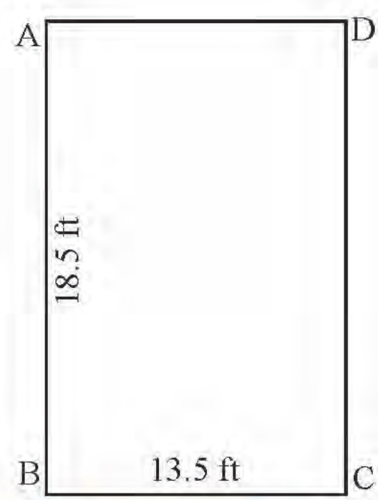
(b)



(c)



(d)



4. **If the length and the breadth of a rectangular towel are 190 cm and 110 cm respectively, what will be its perimeter? Calculate.**
5. **If the length and the breadth of a rectangular field are 27 ft and 22 ft respectively, calculate its perimeter.**
6. **If the length of a square shaped handkerchief is 25 cm, what will be its perimeter? Calculate.**
7. **If the perimeter and breadth of a rectangular ground are 360 m and 60 m, what will be its length? Calculate.**
8. **If the perimeter and the length of a rectangular bed are 22 ft and 6 ft respectively, what will be its breadth? Calculate.**
9. **If the length of a rectangular piece of land is twice its breadth and its perimeter is 42 m, what will its length and breadth? Calculate.**
10. **If the perimeter of a square is 84 cm, what will be its length? Calculate.**
11. **340 trees are planted at equal distance on all four sides of a square shaped ground. How many trees are planted along the length of the ground? Calculate.**

Project work

If a rope is to be placed on the outer edges of the volleyball court located at your village or school, how much rope do you need? Calculate the length and present in your classroom.

Answers

1.	Show the answer to your teacher.				
2.	(a) 26 cm	(b) 40 m	(c) 30 cm	(d) 39 ft	(e) 86 cm
	(f) 140 ft	(g) 160 m			
3.	(a) 10 cm	(b) 16 cm	(c) 18 cm	(d) 64 ft	
4.	600 cm	5. 98 ft	6. 100 cm	7. 120 m	8. 5 ft
9.	14 m, 7 m	10. 21	11. 85 trees		

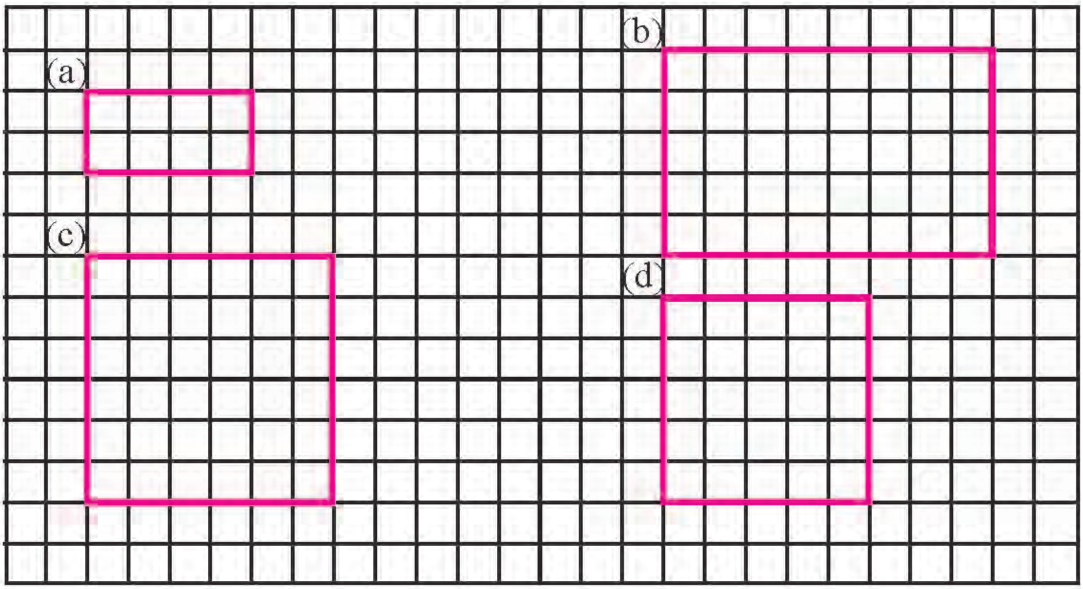
10.2 Area

10.2.1 Area of regular and irregular objects

10.2.1.1 Area of regular objects

Activity 1

Which of the following shapes has occupied the largest space?



Count the number of unit squares occupied by rectangle and square to find the space occupied by the shape in the figure. In the figure (a), the area occupied by the given shape is 8 square units. In the same way, find the area occupied by other shapes and show the answers to your teacher.

10.2.1.2 Area of irregular objects

Activity 2

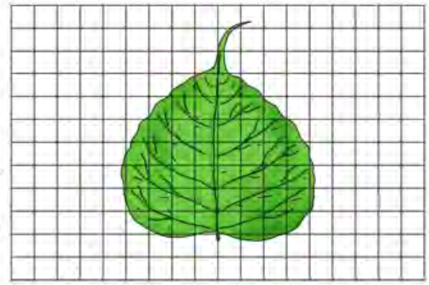
Bring a leaf of any plant. How much space does the leaf occupy? Use graph paper to calculate the surface area of the leaf.

Here,

Number of complete unit squares occupied by the leaf = 34

Number of unit squares (except the complete unit squares) resulting from the addition of partly occupied unit squares 14 (approximately)

Therefore,

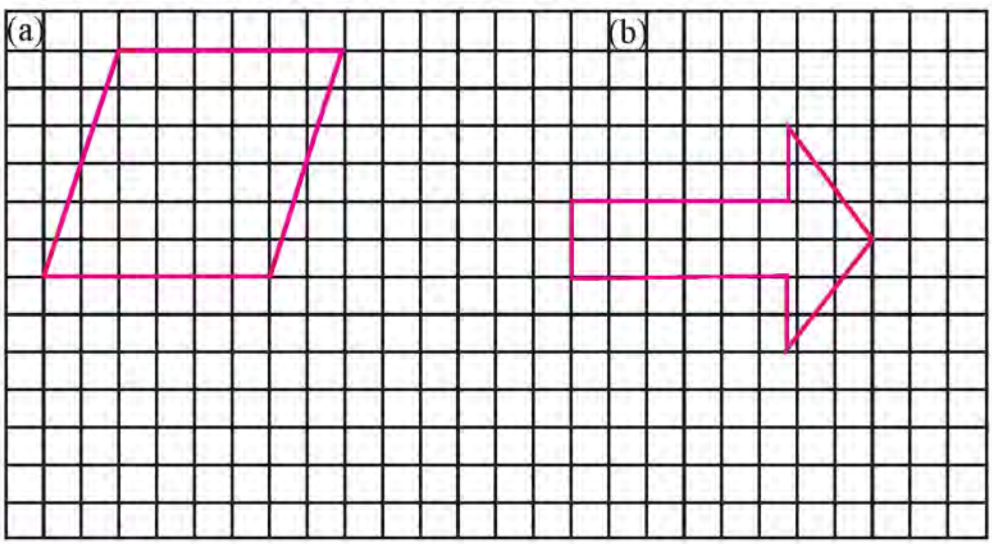


Area of leaf = 34 + 14 = 48 square units (approximately)

The space occupied by the surface of any object on a plane surface is called area of the object. It is easy to find the area of irregular object by using graph paper.

Example 1

Find the area of following shapes by counting unit square:



Solution

Number of complete unit squares in the figure = 30

Number of unit squares resulting from the addition of parts except complete unit squares = 6

Therefore, number of complete unit squares occupied by the shape

= 30 + 6 = 36 square units

∴ Area of parallelogram of figure (a) = 36 square units

(b) Number of complete unit squares in the figure = 14

Number of unit squares resulting from the addition of parts except complete unit squares = 4 (approximately)

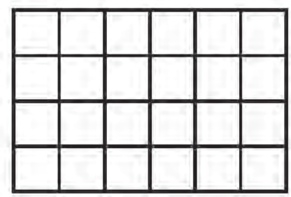
Therefore, number of complete unit squares occupied by the shape

$= 14 + 4 = 18$ square units (approximately)

$\therefore$ Area of arrow figure (b) = 18 square units (approximately)

10.2.2 Area of rectangle and square

Activity 3



Construct a rectangle with its length 6 cm and the breadth 4 cm and construct square boxes with their length 1 cm the inside the rectangle as shown in the figure.

Count the number of square boxes of 1 cm^2 formed horizontally and vertically. Find out the total area occupied by the rectangle.

Here,

Area of rectangle

= Total number of square boxes of 1 cm^2 formed inside the rectangle

= 24 boxes = 24 cm^2

Now, relation among area, length and breadth,

$24\ cm^2 = 6\ cm \times 4\ cm$

$\therefore$ Therefore, area of rectangle = length $\times$ breadth

The product of length and breadth of a rectangular surface is the area of rectangular surface. Area of rectangular surface (A) = length (l) $\times$ breadth (b)

Area of square (A) = length $\times$ length

Or, $A = l \times l = l^2$

Example 2

What is the area of a rectangle with its length 20 cm and the breadth 8 cm? Find it.

Solution:

Here,

Length of rectangle (l) $= 20$ cm

Breadth of rectangle (b) $= 8$ cm

Area of rectangle (A) $= ?$

$$\text{Now, } A = l \times b$$
$$= 20 \times 8$$
$$= 160$$
$$\therefore A = 160 \text{ cm}^2$$

$\therefore$ Area of the rectangle (A) $= 160 \text{ cm}^2$

Example 3

The length of a rectangle is twice its breadth. If the area of rectangle is 50 cm^2, what are its length and breadth? Find it.

Solution:

Here,

Breadth of the rectangle (b) $= x$ cm (suppose)

Then, length of the rectangle (l) $= 2x$ cm

Area of the rectangle (A) $= ?$

Now, $A = l \times b$

or, $50 = 2x \times x$

or, $50 = 2x^2$

or, $x^2 = \dfrac{50}{2}$

or, $x^2 = 25$

$\therefore x = 5$ cm

$\therefore$ Breadth of the rectangle (b) $= 5$ cm

$\therefore$ Length of the rectangle (l) $= 2x = 2 \times 5 = 10$ cm

Example 4

If the area of a square shaped ground is 100 ft², what is its length? Calculate.

Solution:

Here, area of a square shaped ground (A) = 100 ft^2

Area of a square shaped ground (A) = ?

Now, $A = l^2$

or, $100 = l^2$

or, $l = \sqrt{100}$

$\therefore l = 10$ ft

Therefore, length of the square shaped ground (l) = 10 ft

Exercise 10.2

1. **Complete the following sentences with correct numbers or words.**

   (a) The ...... of a square shaped object is calculated by counting the number of squares.

   (b) If the unit of the length and the breadth of a rectangular surface is centimeter, its unit of area is expressed in ....

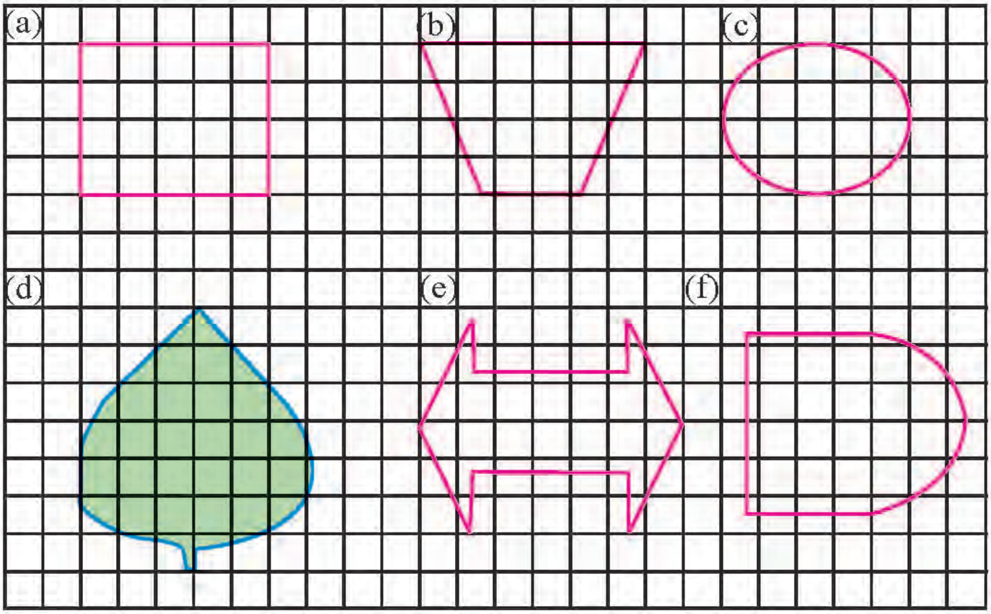
   (c) A piece of paper with its length 3 m and the breadth 2 m occupies ...... of space.

   (d) The area of a paper with its length 5 cm and the breadth 3 cm is ....

   (e) Area of a square shaped cloth with its length 2 m is .... m^2.

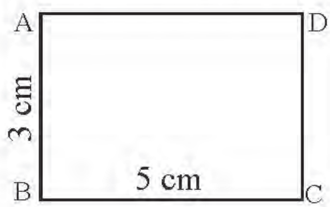
   (f) Surface area of an irregular object is calculated by .... method.

2. Find the area of the following shapes by counting the unit squares in graph.

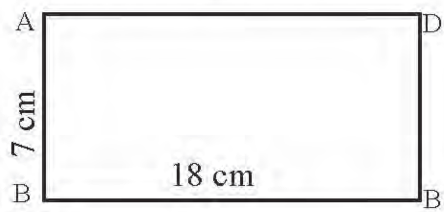


3. Find the area of the following rectangles and squares:

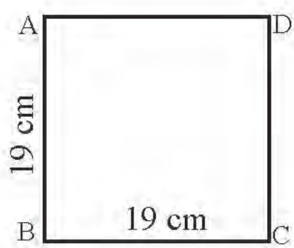
(a)



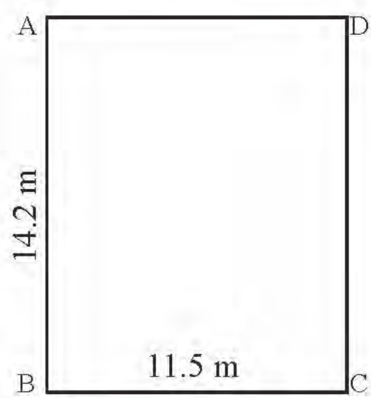
(b)



(c)



(d)



4. Find the length or breadth of the rectangles given below:

(a) Length = 7 ft, Area = 21 ft^2

(b) Length = 18 cm, Area = 90 cm^2

(c) Breadth = 3.2 m, Area = 38.4 m^2

(d) Breadth = 1 ft, Area = 15 ft^2

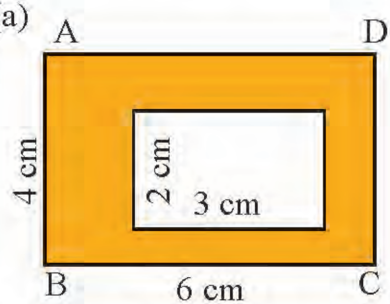
5. **Find the length of the following squares:**

(a) Area = 1 cm^2 (b) Area = 121 ft^2

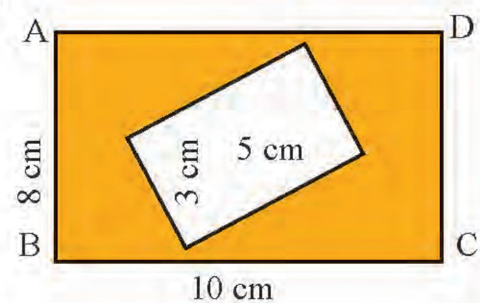
(c) Area = 196 m^2 (d) Area = 625 m^2

6. **Find the area of the shaded portion in the figures given below:**

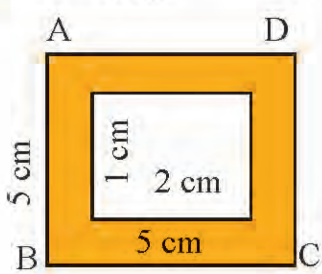
(a)



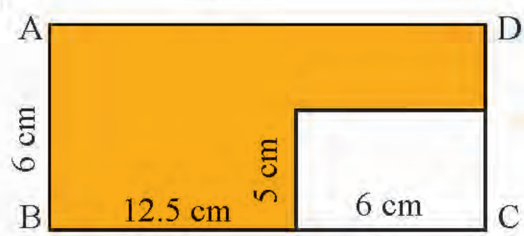
(b)



(c)



(d)



Project work

1. Find the area occupied by your bed on the floor of your room. Present its report in your classroom.
2. Trace the palm of your hand on a graph paper. Count the number of unit squares to calculate the area. Present in the classroom.

Answers

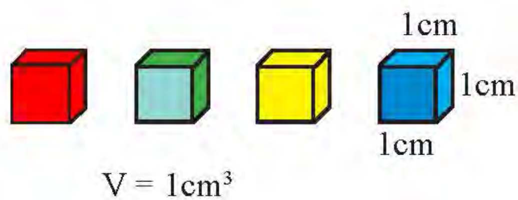
Show the answers of 1 and 2 to your teacher.

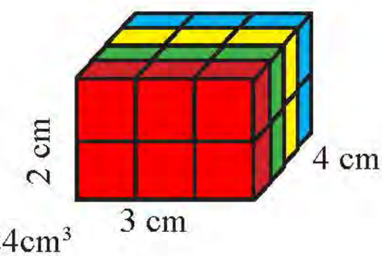
3. (a) 15 cm^2	(b) 126 cm^2	(c) 361cm^2	(d) 163.3 ft^2
4. (a) 3 ft	(b) 5cm	(c) 12 m	(d) 15 ft
5. (a) 1cm	(b) 11 ft	(c) 14 m	(d) 25 m
6. (a) 18 cm^2	(b) 65 cm^2	(c) 23 cm^2	(d) 45 cm^2

10.3 Volume of cuboid and cube

Activity 1

The volume of the unit cube with its length 1 cm is 1 cm^3. Now, arrange 4 and 3 cubes of 1 cm^3 on the length and the breadth side respectively so that they stick together as shown in the figure. Again, put 2 cubes of 1 cm^3 one above the other on the height. Which shape is formed with the arrangements and what is its volume? Discuss.





Here, the cuboid is formed with 4, 3 and 2 cubes of 1 cm^3 on length, breadth and height respectively.

Therefore, there are 24 cubes of 1 cm^3 in the cuboid.

$\therefore$ Volume of the cuboid = 24 cm^3

Now, relation among volume, length, breadth and height,

$24 \text{ cm}^3 = 4 \text{ cm} \times 3 \text{ cm} \times 2 \text{ cm}$

Therefore, volume of the cuboid = length $\times$ breadth $\times$ height

The volume of a cuboid is the total number of unit cubes in that cuboid. The volume of a cuboid is calculated by multiplying its length, breadth and height.

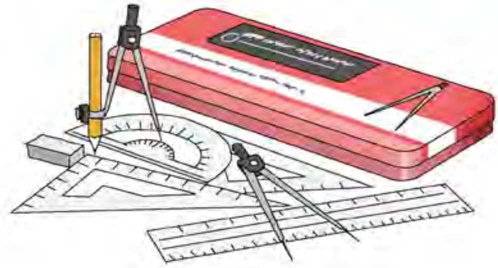
Volume of cuboid (V) = length $\times$ breadth $\times$ height, ($V = l \times b \times h$)

A cuboid in which length, breadth and height are equal is called a cube.

Volume of cubical object (V) = $l \times l \times l = l^3$

Activity 2

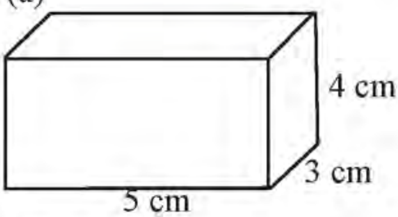
What is the shape of your geometry box? Discuss and find its volume.



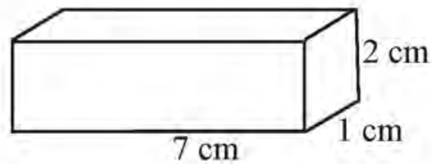
Exercise 10.3

1. **What is the volume of the objects given below? Find it.**

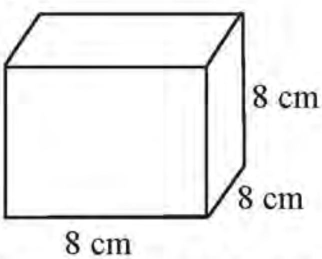
(a)



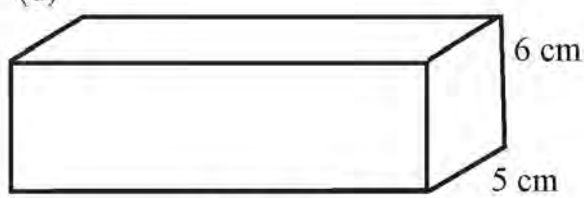
(b)



(c)



(d)



2. **Find the volume of the cuboids on the basis of the given measurements:**

   (a) Length = 12 cm, breadth = 8 cm, height = 4 cm

   (b) Length = 25 ft, breadth = 15 ft, height = 5 ft

   (c) Length = 3.5 m, breadth = 2.2 m, height = 2 m

   (d) Length = 16 cm, breadth = 10.5 cm, height = 5.5 cm

3. **Find the volume of cubes on the basis of the following edge length:**

   (a) Length = 1 m

   (b) Length = 7 m

   (c) Length = 16 ft

   (d) Length = 29 m

4. **If a rectangular box has: length = 55 cm, breadth = 40 cm and height = 25 cm, what is its volume? Calculate.**
5. **If the length of a cubical box = 17 cm, find its volume.**
6. **If the volume of a cubical object is 64 m^3, what is the length of its edge? Find it.**
7. **Length of a cuboid is twice the breadth and the height is 2 ft. If the volume of a cuboid is 100 ft^3, find the length and breadth? Find it.**

Project work

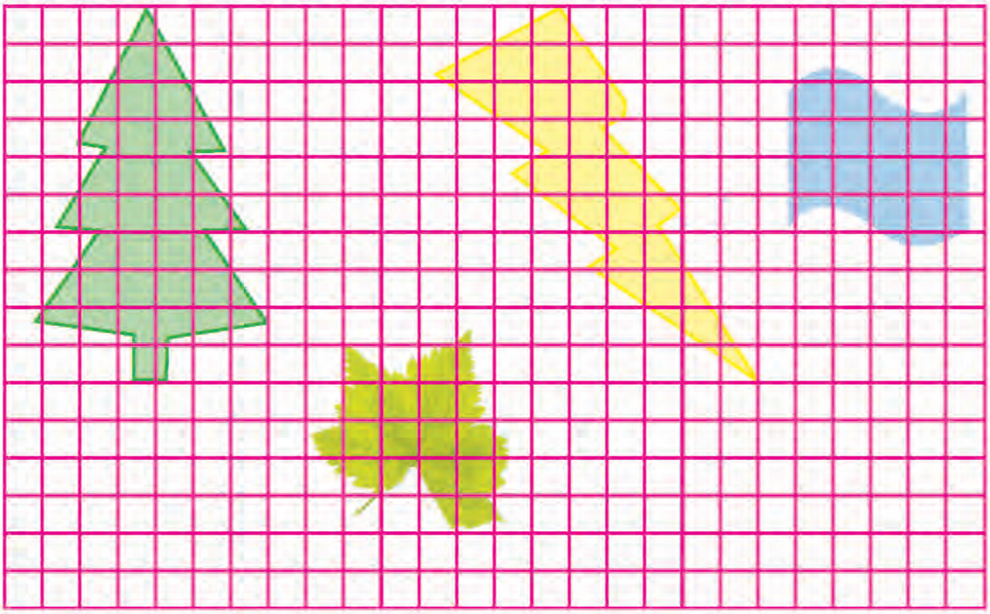
Prepare a cuboid from a piece of wood. Measure its length, breadth and height and find its volume. Prepare a report and present in your classroom.

Answers

1. (a) 60 cm^3	(b) 14 cm^3	(c) 512 cm^3	(d) 405 m^3
2. (a) 384 cm^3	(b) 375 ft^3	(c) 15.4 m^3	(d) 924 cm^3
3. (a) 1 m^3	(b) 343 cm^3	(c) 4096 ft^3	(d) 24389 m^3
4. 55,000 m^3	5. 4913 cm^3	6. 4m	7. 5 ft

Miscellaneous exercise

1. Find the area of the following shapes by counting the square boxes:



2. If the length and breadth of a rectangular towel are 1 m 20 cm and 80 cm respectively, find its perimeter and area.
3. If the area and breadth of a rectangular field are 85 ft^2 and 5 ft respectively, find its perimeter.
4. If the length of a square is 45 cm, find its perimeter and area.
5. If the perimeter and breadth of a rectangular ground are 280 m and 50 m respectively, find its length and area.
6. If the area of a square is 196 cm^2, find its length and perimeter.
7. The length of a rectangular land is twice the breadth and its area is 648 m^2, find the length, breadth and perimeter of the land.
8. If the volume of a cubical object is 1331 cm^3, what is its length?
9. The length of a cuboid is twice the breadth and the height is 5 m. If the volume of the cuboid is 250 m^3, find its length and breadth.

10. **The area of a square and a rectangle is equal. If the area of square is 16 m^2 and the length of a square is half of the length of a rectangle, what is the breadth of the rectangle? Find it.**

11. **Draw the figure of a circle and name its different parts.**

Project work

Measure the length and the breadth of the floor of your kitchen, bedroom, living room and bathroom separately; find their area. Also, find the total area of those places and present with the report in the classroom.

Answers

1. Show the answer to your teacher.
2. 400 cm and 9600 cm^2
3. 44 ft.
4. 180 cm and 2025 cm^2
5. 90 cm and 4500 cm^2
6. 14 cm and 56 cm
7. 96 m, 18m and 108 m
8. 11 cm
9. 5 m and 5 m
10. 2 m
11. Show the answer to your teacher

Unit Four | Algebra

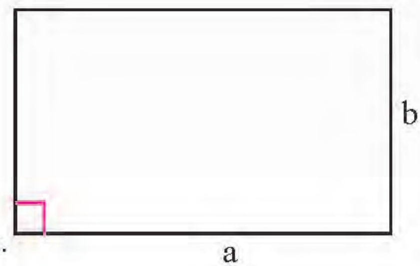
Lesson 11

Indices

11.0 Review

Study the conditions given below.

What is the area of the given rectangle?



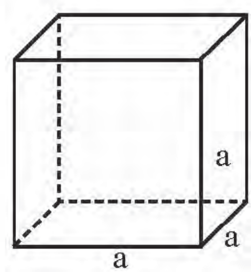
Here, $A = a \times b$

If length = breadth = a unit,

$A = a \times a = a^2$ square units.

Therefore, a^2 means a is multiplied twice.

To find the volume of the given cube



$V = a \times a \times a$

$V = a^3$

Here, a^3 means a is multiplied thrice.

2 is multiplied 5 times.

Therefore, we can write $2 \times 2 \times 2 \times 2 \times 2 = 2^5$

We use power to denote how many times a number or a variable is multiplied by the same number or variable.

Example: In $x \times x \times x \times x$, x is multiplied 4 times.

This is written as x^4.

Here, in x^4, x is called the base.

and 4 is called the indices of x.

Example 1

Write the following numbers in indices form.

(a) $3 \times 3 \times 3 \times 3$ (b) $2 \times 2 \times 2 \times 3 \times 3$

Solution:

(a) Here, $3 \times 3 \times 3 \times 3$

3 is multiplied 4 times.

Therefore, $3 \times 3 \times 3 \times 3 = 3^4$

(b) $2 \times 2 \times 2 \times 3 \times 3$

Here, 2 is multiplied 3 times and 3 is multiplied 2 times.

Therefore, $2 \times 2 \times 2 = 2^3$ and $3 \times 3 = 3^2$

$\therefore 2 \times 2 \times 2 \times 3 \times 3 = 2^3 \times 3^2$

Example 2

Write the following in forms of indices:

(a) $2x \times x$ (b) $a^2 \times a$

Solution:

Here, $2x \times x$

$= 2 \times x^2$

$= 2x^2$

Here, $a^2 \times a$

$= a^3$

Example 3

Write the following indices in expanded form:

(a) c^2 (b) y^5 (c) x^2y^2

Solution:

(a) In c^2, c should be multiplied 2 times.

$c^2 = c \times c$

(b) In y^5, y should be multiplied 5 times.

Therefore, $y^5 = y \times y \times y \times y \times y$

(c) In x^2y^2, x should be multiplied 2 times and y should be multiplied 2 times.

Therefore, $x^2y^2 = x \times x \times y \times y$

Example 4

Write the formula to find the volume of a cuboid shaped solid object having length (*l*), breadth (b) and height (h). If the length of the length, the breadth and the height of the solid object is b, what is its volume?

Solution:

Here, the solid object has length (l), breadth (b) and height (h).

Therefore, volume (V) = $l \times b \times h$

Again, if length = breadth = height = b unit,

Volume (V) = $b \times b \times b = b^3$ cubic unit

Exercise 11.0

1. **Write in indices forms:**

(a) $3 \times 3 \times 3$ (b) $5 \times 5 \times 5 \times 5$ (c) $a \times a \times a \times a \times a$

(d) $2 \times 2 \times 3 \times 3 \times 3 \times 3$ (e) $x \times x \times x \times y \times y$

(f) $a \times a \times a \times a \times b \times b \times b$

2. **Write the expanded forms of the given indices:**

(a) b^4 (b) $c^3 \times c^2$ (c) l^2 (d) $a^2 \times b^2$

(e) $y^2 \times y^2 \times p$ (f) $l^3 \times b^2 \times h^2$ (g) $z \times z^3 \times z^2$

3. **Write in indices forms by calculating:**

(a) $4x^2 \times x^2$ (b) $x^5 \times x^2$ (c) $3x^3 \times 6x^3$

4.(a) (i) What is the area of a rectangle if its length = x unit and the breadth = y unit?

(ii) If the length and breadth is y unit, what is its area?

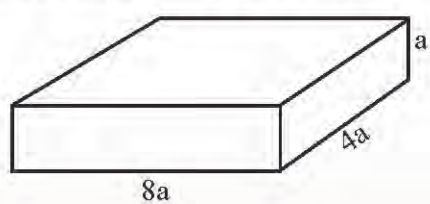
(iii) If the value of y is 8, what is the area of the shape?

(b) (i) If the length, breadth and height of a solid object are a, b and c units respectively, what is its volume?

(ii) What will be the volume of the solid object if it has the same measurement 'a' for its length, breadth and height?

(iii) If the value of a is 11 cm in the question (ii), what is the volume of the object?

(c) Find the volume of the given solid object and write the answer in indices form.



Answers

Show all answers to your teacher.

Lesson 12

Algebraic Expression

12.0 Review

The entrance fee of a person to enter a park is Rs. 100. The charge for completing going around the park a rented bicycle is Rs. 10. The charge of going around twice Rs. 20. The charge of going around the park by a rented bicycle is 10 times of the number of rounds.

Or, the charge for going round the park by rented bicycle = Rs. 10 × number of rounds in the park.

Let the number of rounds in the park be x. Then,

The charge for going around by rented bicycle in the park = Rs. $10 \times x$ = Rs. $10x$

Similarly, if the charge for going around the park on a horseback = Rs. 50, the charge for y rounds = Rs. 50y. Discuss the following questions in pair and present in your classroom:

(a) Is Rs. 100 a variable or a constant? Why?

(b) Is 'x' a variable or a constant? Why?

(c) Are 100, 10x and 50y algebraic terms? Can they also recalled algebraic expression?

(d) Anu entered the ramailo park on Saturday, and she look x round by bicycle, how much did she pay at the above rate? Write in mathematical symbols.

(e) Is mathematical symbol of (d) an algebraic expression? How many terms are there?

(f) What type of terms are x and 10x?

(g) What type of terms are 10x and 50y?

A quantity having a single fixed value is called a constant. A quantity that has more than one value is called a variable. Terms having same variable (base) and equal power are called like terms. Terms having different variable (base) or different power are called unlike terms. Therefore, if the algebraic factors of algebraic terms are same, they are called like terms and if algebraic factors are different, they are called unlike terms. Example: In 3xy and 2xy, factors of 3xy are 3, x, y and factors of 2xy are 2, x, y. Algebraic factors of these two terms are same x and y, these are like terms.

12.1 Addition and subtraction of algebraic expression

1. **Write the statements given below in terms of algebraic expressions; discuss with your friend to reach the conclusion.**
   (a) Rupa had x marbles. If Rupak gave her 3 marbles, how many marbles would Rupa have?
   (b) If Dipesh has given 7 pencils to his brother from y pencils, how many pencils are left with Dipesh?
   (c) Sushila had y exercise books. If teacher gave her twice the number of exercise books she had, how many exercise books did Sushila have?
   (d) Suraksha has x chocolates. If she distributes it equally between her two brothers, how many chocolates will each of them?
   (e) How many algebraic terms are in each of the above statements? Write.

   Here, writing the above statements in algebraic expression,

   (a) $x + 3$
   (b) y - 7
   (c) y + 2y
   (d) $\frac{x}{2}$
   (e) d is monomial and a, b and c are binomial expressions.

The mathematical statements above are monomial or binomial expressions. In these statements, variables and constants are connected by four fundamental operations of Mathematics.

Mathematical relation formed by the connection of variables and constants with four fundamental operations of Mathematics (addition, subtraction multiplication and division) is called algebraic expression.

Example 1

1. **Categorize each pair of terms below into like and unlike terms:**

(a) $2x$ and $5x$ (b) $4a$ and $7a$ (c) $3x$ and $4y$ (d) $5a$ and $6b$

(e) $3a^2$ and $7a^2$ (f) $7x^3$ and $9x^2$ (g) $2a^2$ and $13a^3$ (h) $3a^2b$ and $3b^2a$

(i) $4x^2y$ and $7x^2yz$

Solution:

(a) $2x$ and $5x$ are like terms because both have variable x.

(b) $4a$ and $7a$ are like terms because both have variable a.

(c) $3x$ and $4y$ are unlike terms because x is the variable of first term and y is the variable of second term.

(d) $5a$ and $6b$ are unlike terms because a is the variable of first term and b is the variable of second term.

(e) $3a^2$ and $7a^2$ are like terms because both have variable a^2.

(f) $7x^3$ and $9x^2$ are unlike terms because x^3 is the variable of first term and x^2 is the variable of second term.

(g) $2a^2$ and $13a^3$ are unlike terms because a^2 is the variable of first term and a^3 is the variable of second term.

(h) $3a^2b$ and $8ab^2$ are unlike terms because a^2b is the variable of first term and ab^2 is the variable of second term.

(i) $4x^2y$ and $7x^2yz$ are unlike terms because x^2y is the variable of first term and x^2yz is the variable of second term.

Example 2

Find the sum of :

(a) $3x$ and $4x$ (b) x, $4x$ and $5x$ (c) $2x$, $3y$ and $7x$

(d) $2a^2b$, $3a^2b$ and $6a^2b$ (e) $12x^2y$, $15x^2y$ and $5x^2yz$

Solution:

(a) The sum of $3x$ and $4x = 3x + 4x = 7x$

(b) The sum of x, $4x$ and $5x = x + 4x + 5x = 10x$

(c) The sum of $2x$, $3y$ and $7x = 2x + 3y + 7x = 2x + 7x + 3y = 9x + 3y$

(d) The sum of $2a^2b$, $3a^2b$ and $6a^2b = 2a^2b + 3a^2b + 6a^2b = 11a^2b$

(e) The sum of 12x2y, 5x2yz and 15x2y $= 12x^2y + 5x^2yz + 15x^2y$

$= 12x^2y + 15x^2y + 5x^2yz = 27x^2y + 5x^2yz$

Example 3

Subtract:

(a) x from $8x$ (b) $x + 4x$ from $5x$ (c) $2x - 3y$ from $6x$

(d) $9a^3b - 7a^2b$ from $5a^3b$ (e) $2p^2q + 11p^2q$ from $5p^2qr$

Solution:

(a) $8x - x = 7x$

(b) $x + 4x - 5x = 5x - 5x = 0$

(c) $2x - 3y - 6x = 2x - 6x - 3y = -4x - 3y$

(d) $9a^3b - 7a^2b - 5a^3b = 9a^3b - 5a^3b - 7a^2b = 4a^3b - 7a^2b$

(e) $2p^2q + 11p^2q - 5p^2qr = 13p^2q - 5p^2qr$

Exercise 12.1

1. **Separate the following statements whether they are *true* or *false*:**

   (a) 3x is the sum of x and 3.

   (b) If the value of x is 5, x is called a constant.

   (c) $6a^2$ is the sum of $2a$ and $4a^2$.

   (d) 3x is the difference if $2x$ is subtracted from $5x$.

   (e) In $x - 2 = 8$, the value of x is 10.

   (f) If $y = 1$, the value of $y^2 + 1$ is 3.

   (g) If $x = 2$ and $y = 3$, the value of $x^2 + y^2$ is 3.

2. **Categorize x, y, z, a, b and c in each of the following situations into variable or constant:**

   a. x represents the number of books you have.

   b. y represents the total number of teachers in your school.

   c. z represents the odd number between 2 and 4.

d. The value of a is 7.

e. b represents the counting numbers between 1 and 9.

f. c represents the sum of 1 and 2.

3. Make algebraic expressions of each condition given below:

a. Ram has x copies. If her sister given him 5 exercise books, how many copies does Ram have?

b. If Resma has given 3 pens out of y pens to her friend, how many pens will be left with Resma?

c. In x stick, if its double is added, what will be the total number of sticks?

d. There were z students in Rastriya secondary school; if y students were absent on a day, how many students were present?

e. Hari has x biscuits; his friend has given him 1 biscuit, how many biscuit does Hari have now?

f. How many algebraic terms are in each of the above statements? Write.

4. Find the sum:

(a) $3s$ and $7s$ (b) $2m$ and $6m$ (c) $2xy$ and $5xy$ (d) $6a^2$ and $8a^2$

(e) $5x^2y$ and $3x^2y$ (f) a, $2a$ and $3a$ (g) $2x^2$, $5x^2$ and $7x^2$

(h) $3x^2y$, $4x^2y$ and $5xy^2$ (i) m^2n, $2mn^2$ and $6mn^2$

(j) $4a^3b$, $6a^3b$ and $9ab^3$ (k) $(2a + 3)$ and $(3a + 5)$

(l) $(3x^2 + 4x + 5)$ and $(5x^2 + 6x + 7)$

5. Find the difference:

(a) $(2x + 2y)$ from $(3x + 4y)$

(b) $(a + b)$ from $(6a + 4b)$

(c) $(2x + 3y + 4z)$ from $(6x + 7y + 8z)$

(d) $(2a + b - 3c)$ from $(4a - 3b + 5c)$

(e) $(a - 2b - 3c)$ from $(7a - 5b - 7c)$

(f) $(x^2 - xy + 2y^2)$ from $(2x^2 - xy + y^2)$

(g) $(2x^3 + 3x^2y + 4y^3)$ from $(6x^3 + 5x^2y + y^3)$

6. **Simplify:**

(a) $(4a + 6a - 9a)$

(b) $5x - 6x + 3x$

(c) $6m^2 + 3m^2 - 9m^2$

(d) $(x^2 + xy + y^2) - (x^2 - xy + y^2)$

(e) $(5x^2 + xy + y^2) + (3x^2 + 2xy + 4y^2)$

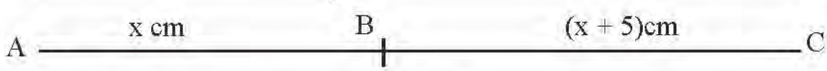
(f) $(2a - 3b + 7c) - (2a + 3b + 7c)$

(g) $(a + 2b + 3c) - (3a + 4b + 5c)$

(h) $(6x^3 - 2x^2y - y^3) + (4x^3 + x^2y + 3y^3)$

7. **Find the total length of each of the line segments given below:**

(a) 

(b) 

(c) 

(d) 

Answers

Show the answer of 1 and 2 to your teacher.

3. (a) $x + 5$ (b) $y - 3$ (c) $x + 2x$ (d) $z - y$ (e) $a + 1$
   (f) All have two terms (binomial)
4. (a) $10s$ (b) $8m$ (c) $7xy$ (d) $14a^2$ (e) $8x^2y$ (f) $6a$
   (g) $14x^2$ (h) $7x^2y + 5xy^2$ (i) $m^2n + 8mn^2$ (j) $10a^3b + 9ab^3$
   (k) $5a + 8$ (l) $8x^2 + 10x + 12$
5. (a) $x + 2y$ (b) $5a + 3b$ (c) $4x + 4y + 4z$ (d) $2a - 4b + 8c$
   (e) $6a - 3b - 4c$ (f) $x^2 - y^2$ (g) $4x^3 + 2x^2y - 3y^3$
6. (a) a (b) $2x$ (c) 0 (d) $2xy$ (e) $8x^2 + 3xy + 5y^2$
   (f) $-6b$ (g) $-2a - 2b - 2c$ (h) $10x^3 - x^2y + 2y^3$
7. (a) $3x$ cm (b) $(2x + 5)$cm (c) $6x$ cm (d) $4x + 6$

12.2 Multiplication of algebraic expression

12.2.1 Multiplication of monomial algebraic expressions

Activity 1

Draw a rectangle having its length 3a cm and the breadth 2b cm. Draw small rectangles so that each rectangle has a cm in length and b cm in breadth as shown in the figure. Find the area of small and big rectangles and discuss with your friend to reach the conclusion.

Present the conclusion in classroom.

Now, the area of rectangle ABCD = Area of 6 small rectangles

$= (ab + ab + ab + ab + ab + ab)\ cm^2$

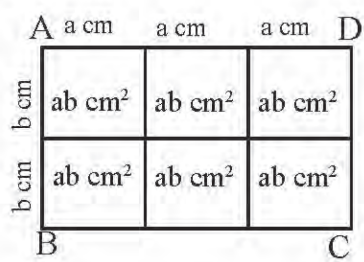
$= 6ab\ cm^2$

Again, the area of rectangle ABCD = length × breadth

$6ab\ cm^2 = 3a \times 2b$

Therefore,

$3a \times 2b = 6ab\ cm^2$



In multiplication of monomial algebraic expressions, multiply coefficient 3 of the above first part 3a by coefficient 2 of 2b (3 × 2) then multiply it with the product of variables ab.

In multiplication of monomial algebraic expressions, product of coefficients is kept in front of product of variables. If the product of coefficients is 1, it is not written. Example: $1 \times b = b$, $a \times b = ab$

Example 1

1. Multiply:

(a) $2x \times 3x$ (b) $3y \times 4y \times 5y$ (c) $5c \times 7d$ (d) $\frac{2}{3}a \times 6b \times \frac{c}{4}$

Solution:

Here, (a) $2x \times 3x = 2 \times 3 \times x \times x = 6 \times x^2 = 6x^2$

(b) $3y \times 4y \times 5y = 3 \times 4 \times 5 \times y \times y \times y = 60 \times y^3 = 60y^3$

(c) $5c \times 7d = 5 \times 7 \times c \times d = 35 \times cd = 35cd$

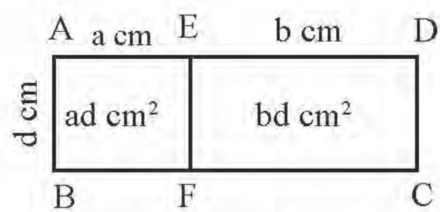
(d) $\frac{2}{3}a \times 6b \times \frac{c}{4} = \frac{2}{3} \times 6 \times \frac{1}{4} \times a \times b \times c = \frac{12}{12} \times abc$

$= 1 \times abc = abc$

12.2.2 Multiplication of binomial by monomial algebraic expressions

Activity 2

What is the area of rectangle having the length (a + b) cm and the breadth d cm? Discuss.



Here, the area of rectangle ABCD = area of rectangle ABFE × area of rectangle EFCD

$= ad\ cm^2 + bd\ cm^2$

$= (ad + bd)\ cm^2$

Again, the area of rectangle ABCD = length × breadth

$$(ad + bd)\ cm^2 = (a + b)\ cm \times d\ cm$$

Therefore,

$$(a + b)\ cm \times d\ cm = (ad + bd)\ cm$$

In the multiplication of binomial by monomial algebraic expressions, multiply each term of binomial expression by the monomial expression and add the products.

Example 2

Multiply:

(a) $3x \times (4y + 5z)$ (b) $8a \times (2a + 9ac)$

Solution:

Here, (a) $3x \times (4y + 5z) = 3x \times 4y + 3x \times 5z = 12xy + 15xz$

(b) $8a \times (2a + 9ac) = 8a \times 2a + 8a \times 9ac = 16a^2 + 72a^2c$

Example 3

Find the value of:

If $x = 2$ and $y = 3$,

(a) $x^2 + y^2$ (b) $x^2 + 2xy + y^2$ (c) $x^3 - 2x^2y + y^2$

Solution:

Here, $x = 2$ and $y = 3$

(a) $x^2 + y^2 = 2^2 + 3^2 = 4 + 9 = 13$

(b) $x^2 + 2xy + y^2 = 2^2 + 2 \times 2 \times 3 + 3^2 = 4 + 12 + 9 = 25$

(c) $x^3 - 2x^2y + y^2 = 2^3 - 2 \times 2^2 \times 3 + 3^2 = 8 - 24 + 9 = 8 + 9 - 24$

$= 17 - 24 = -7$

Exercise 12.2

1. **Fill the appropriate values in the following sentences below:**
   (a) Product of x and 1 is …
   (b) 0 multiplied by 2a gives …
   (c) Product of 3x and 4 is …
   (d) 5y multiplied by … gives 15y.
   (e) $3y(2x-2) = …$
   (f) If $p = 2$, the value of $p^2 – 1$ is …
   (g) If $a = 2$ and $b = 3$, the value of $a(a + b)$ is …
2. **Multiply:**

(a) $0 \times a$ (b) $1 \times b$ (c) $2a \times 9b$ (d) $a \times b \times c$ (d) $8b \times 9c$
(e) $2p \times 3q \times 4r$ (f) $2a \times 5a$ (g) $4x \times 7x$

(h) $3l \times 4m \times 5n$ (i) $2x \times 4y \times 5y$ (j) $5p \times 6p \times 7q$

(k) $\frac{2x}{5} \times 20y \times \frac{z}{4}$

3. Multiply:

(a) $a \times (b + c)$ (b) $2x \times (3y + 4z)$ (c) $2p \times (q + 3)$

(d) $3l \times (2l + 3m)$ (e) $3a \times (5a + 7b)$ (f) $2x \times (3x + 4y)$

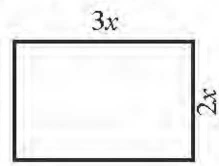
(g) $5x \times (4x - 5y)$

4. Answer the following questions on the basis of the given figure:

(a) What is the area of rectangle?

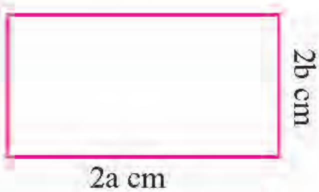
(b) Find the perimeter of the rectangle.

(c) If x = 7, find the area and perimeter of the rectangle?

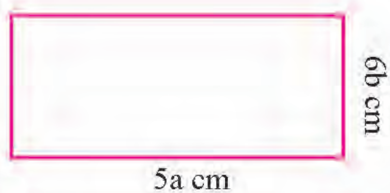


5. Area of rectangle (A) = length (l) × breadth (b). Find the area of each rectangle given below:

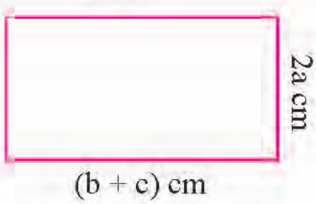
(a)



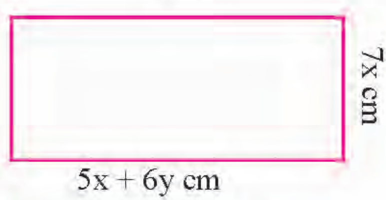
(b)



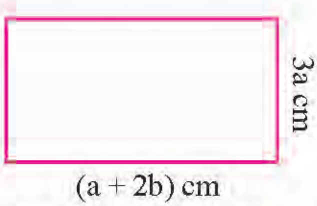
(c)



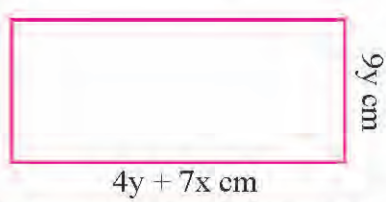
(d)



(e)



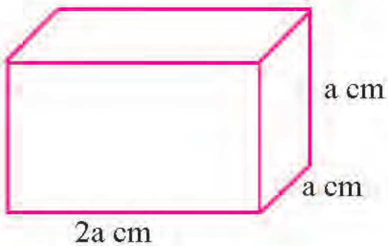
(f)



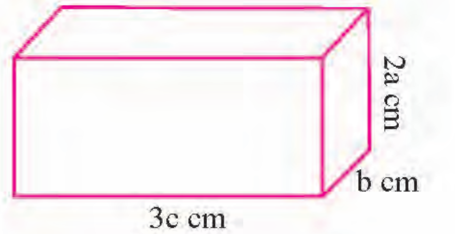
6. In question no. 5, if a = 1, b = 2, c = 3, x = 4 and y = 5, find the true area of each rectangle.

7. **The volume of a rectangular solid object (V) = length (l) × breadth (b) × height (h). Find the volume of each rectangular solid object given below.**

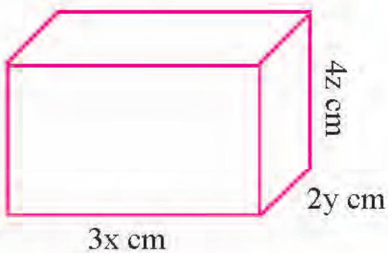
(a)



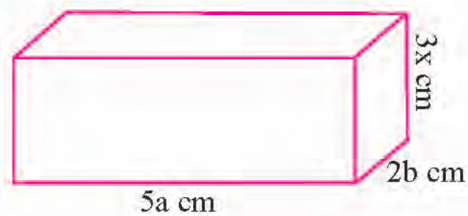
(b)



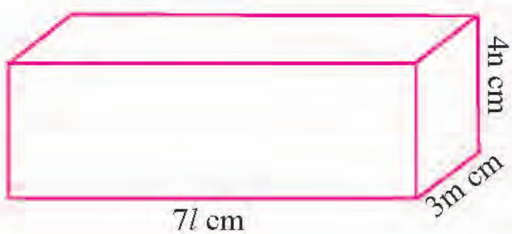
(c)



(d)



(e)



8. **If a = - 2, b = 3 and c = 4, find the value of algebraic expressions given below:**

(a) $a + b$ (b) $a - b + c$ (c) $2a + 3b + 4c$

(d) $5a - 3c + 7b$ (e) $3a \times 4b \times 5c$ (f) $6a^2 + 5b^2 - 7c^2$

(g) $a^2 + 2abc + b^2$ (h) $b^2 + 2bc - ac^2$

Answers

1. (a) x (b) 0 (c) 12x (d) 3 (e) $6xy - 6y$ (f) 3 (g) 10
2. (a) 0 (b) b (c) 18ab (d) abc (e) 72bc (f) 24pqr
   (g) $10a^2$ (h) $28x^2$ (i) $60lmn$ (j) $40xy^2$ (k) $210p^2q$ (l) 2xyz
3. (a) $ab + ac$ (b) $6xy + 8zx$ (c) $2pq + 6p$ (d) $6l^2 + 9lm$
   (e) $15a^2 + 21ab$ (f) $6x^2 + 8xy$ (g) $20x^2 - 25xy$
4. (a) $6x^2$ (b) 10x (c) 294 cm^2 and 70cm
5. (a) 4ab cm^2 (b) 30ab cm^2 (c) (2ab + 2ac) cm^2
   (d) $(35x^2 + 42xy)$ cm^2 (e) $(3a^2 + 6ab)$ cm^2 (f) $(36y^2 + 63xy)$ cm^2
6. (a) 8 cm^2 (b) 60 cm^2 (c) 10 cm^2 (d) 1400 cm^2 (e) 15cm^2
   (f) 2160 cm^2
7. (a) $2a^3$ cm^3 (b) 6abc cm^3 (c) 24xyz cm^3 (d) 30abx cm^3
   (e) $84lmn$ cm^3
8. (a) 1 (b) -1 (c) 21 (d) -1 (e) -1440 (f) 181 (g) -35 (h) 65

12.3.1 Division of monomial by monomial algebraic expression

Activity 1

What is the breadth of a rectangular field which has 4xy cm^2 area and the length 2x cm? Discuss.

Here, area of rectangle ABCD (A) = 4xy cm^2

length (l) = 2x cm

breadth (b) = ?

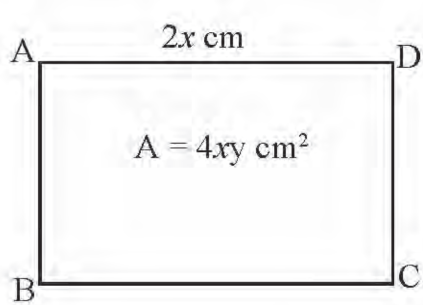
Now, $A = l \times b$

or, $\frac{A}{l} = \frac{l \times b}{l}$

or, $b = \frac{A}{l}$

or, $b = \frac{4xy}{2x}$

$\therefore$ b = 2y cm



12.3.2 Division of binomial by monomial algebraic expression

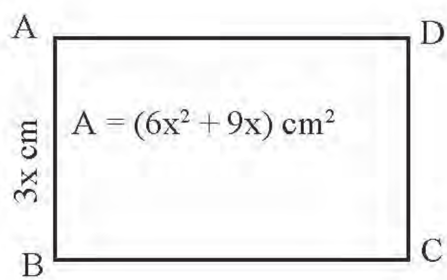
Activity 1

What is the length of a rectangular field with $(6x^2 + 9x)$ cm² area and the breadth 3x cm?

Here, area of rectangle ABCD (A) = $(6x^2 + 9x)$ cm²

breadth (b) = 3x cm

length (l) = ?



Now, $A = l \times b$

$$\text{or, } \frac{A}{b} = \frac{l \times b}{b}$$

$$\text{or, } l = \frac{6x^2 + 9x}{3x}$$

$$\text{or, } l = \frac{6x^2}{3x} + \frac{9x}{3x}$$

$$\therefore l = (2x + 3) \text{ cm}$$

In the division of binomial by monomial algebraic expression, divide separately both expressions of numerator by the expression of denominator.

Example 1

Divide:

(a) $12ab \div 4a$ (b) $18a^2b \div ab$ (c) $(21x^3y^2 - 56x^2y^3) \div 7x^2y^2$

Solution:

(a) Here, $12ab \div 4a = \dfrac{12ab}{4a} = \dfrac{2 \times 2 \times 3 \times a \times b}{2 \times 2 \times a} = 3b$

(b) Here, $18a^2b \div 3ab = \dfrac{18a^2b}{3ab} = \dfrac{2 \times 3 \times 3 \times a \times a \times b}{3 \times a \times b} = 2 \times 3 \times a = 6a$

(c) Here, $(21x^3y^2 - 56x^2y^3) \div 7x^2y^2 = \dfrac{21x^3y^2 - 56x^2y^3}{7x^2y^2}$

$$= \frac{21x^3y^2}{7x^2y^2} - \frac{56x^2y^3}{7x^2y^2}$$

$$= \frac{3 \times 7 \times x^2 \times x \times y^2}{7 \times x^2 \times y^2} - \frac{2 \times 2 \times 2 \times 7 \times x^2 \times y^2 \times y}{7 \times x^2 \times y^2}$$

$$= 3 \times x - 2 \times 2 \times 2 \times y$$

$$= 3x - 8y$$

Exercise 12.3

1. **Divide:**

(a) $ab \div a$ (b) $3x^2y \div y$ (c) $20x^3y^2 \div 4x^2y$ (d) $12x^3y^3z^2 \div 3x^3y^2z$

(e) $36l^7m^3n^2 \div 4l^6m^2n$ (f) $100p^4q^7r^6 \div 25p^3q^4r^5$

2. **Divide:**

(a) $(xy + xz) \div x$ (b) $(x^2 - 2xy) \div x$

(c) $(a^2bc + abc^2) \div abc$ (d) $(5l^2m - 15lm^2) \div 5lm$

(e) $(14p^3q^2 + 49p^2q^3) \div 7p^2q^2$ (f) $(36ax^3y^3 - 18bx^2y^2) \div 9x^2y^2$

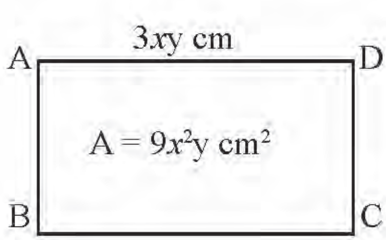
(g) $(40u^3v^2 - 24u^2v^3) \div 8u^2v^2$

3. (a) If the area of a rectangular land is $9x^2y^3$ square meter, what will be its length and breadth?

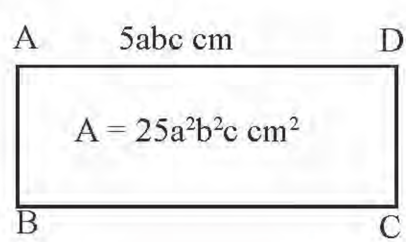
(b) If the area of a rectangular garden is $32a^2b^2$ square meter, what will be its length and breadth?

4. **Find the length of the remaining sides of the rectangles given below:**

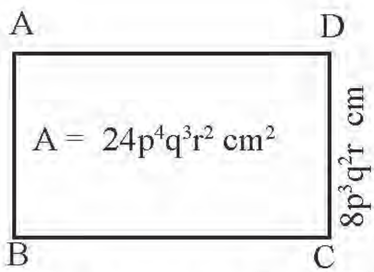
(a)



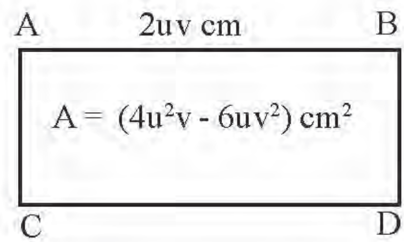
(b)



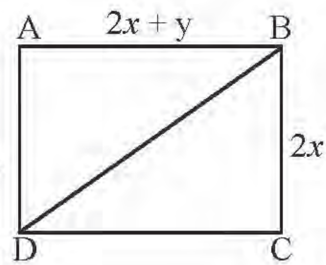
(c)



(d)



5. In the adjoining figure, ABCD is a rectangle. Answer the following questions based on given information.



(a) What is the perimeter of rectangle?

(b) What is the area of rectangle?

(c) DB bisects rectangle ABCD. What is the area of ΔABD?

(d) How much should the rectangle be reduced in length to make it a square?

(e) What will be the area of square?

Answers

1. (a) b (b) $3x^2$ (c) $5xy$ (d) 4yz (e) $9lmn$ (f) $4pq^3r$
2. (a) y + z (b) $(x - 2y)$ (c) a + c (d) $l - 3m$ (e) 2p + 7q
   (f) $4axy - 2b$ (g) 5u–3v
3. Show the answer to your teacher.
4. (a) $3x$ cm (b) 5ab cm (c) 3pqr cm (d) (2u – 3v) cm
5. (a) $8x + 2y$ (b) $4x^2 + 2xy$ (c) $2x^2 + xy$ (d) y (e) $4x^2$

Lesson 13

Equation, Inequality and Graph

13.0 Review

How will the following statements be written in mathematical sentences. Discuss:

(a) Ram has less than Rs. 20.

(b) Shailesh's age is at most 12 years.

(c) I walk at least 3 km everyday in the morning.

Writing the above statements in mathematical sentence.

(a) $x < 20$ (b) $x \leq 12$ (c) $x \geq 3$

13.1 Mathematical statements

Activity 1

The statements that include four fundamental operations of mathematics (addition, subtraction, multiplication and division) are called mathematical sentence. Study the mathematical statements written on the board given in the figure below:

Mathematical statements

(a) 2 is an even prime number.

(b) $3 + 5 = 8$

(c) There is an odd number between 4 and 6.

(d) The product of 3 and 5 is 8.

(e) The difference between 9 and 7 is 3.

(f) x is a factor of 18.

(g) $x \neq 5$

(h) $y < 7$

Which of the above statements can surely be termed as true or false statements? Can any of the statement be neither true nor false? What are they? Discuss.

True statement	False statement	Open statement
(a) 2 is an even prime number.	(d) The product of 3 and 5 is 8.	(f) x is a factor of 18.
(b) $3 + 5 = 8$	(e) The difference between 9 and 7 is 3.	(g) $x \neq 5$
(c) There is an odd number between 4 and 6.		(h) $y < 7$

It's sure that the statements given in (a), (b) and (c) are true the statements where as the statements given in (d) and (e) are false ones. But the statements given in (f), (g) and (h) can neighter be true nor. These mathematical statements only become true if we put two or more values of variables.

Example: The statement given in (f) can only be true if we put x = 1,2,3,6,9,18. These mathematical statements are open mathematical statements.

Mathematical statement that cannot be said with certainty as true or false is called open statement.

Exercise 13.1

1. **Find whether each of the following mathematical statement is true or false:**
   (a) The sum of 4 and 3 is 7.
   (b) The difference of 8 and 5 is 3.
   (c) 3 is an even number.
   (d) 2 is smaller than 3.
   (e) 5 and 6 are not equal.

(f) The area of a square having the side measuring 3 cm is 6 cm^2.

(g) There are 3600 seconds in 1 hour.

(h) When 25 is divided by 3, the remainder is 2.

(i) The square of 12 is 24.

(j) The sum of 6 and 4 is equal to the product of 2 and 5.

(k) There are 3 prime numbers in total between 1 and 10.

(l) 3 and 6 are 2 factors of 18.

(m) If $y + 3 = 7$, $y = 4$.

(n) $1 + 3 > 2 + 1$

(o) $4 + 5 < 6 - 1$

2. Find whether each of the following mathematical statements is true, false or open:

(a) 5 is a prime number.

(b) The cube of 2 is 9.

(c) y is a smaller number than 7.

(d) There are 3 square numbers between 10 and 30.

(e) 15 is exactly divisible by x.

(f) z is a multiple of 5.

(g) If $a = 3$, then $2a^2 = 9$.

(h) b represents even number between 10 and 20.

(i) 3 is an odd number.

(j) If $x - 3 = 2$ then $x = 6$.

3. What will be the values of variables x, y and z in the following open mathematical statements to make them true? Find.

(a) When 8 is multiplied by x, the product is 24.

(b) $y \div 3 = 5$

(c) z is an odd number.

(d) $x \in$ {even number}

(e) The sum of x and 15 is 15.

(f) $y > 7$

(g) $y \neq 13$

(h) x is an odd number between 9 and 12.

(i) $y - 6 = 10$

(j) $x - 3 < 9$

(k) $2z > 6$

Project work

Search over the internet or ask with parents and neighbour for ten mathematical statements. Categorize them into: true, false or open mathematical statement with reason. Prepare a report and present in the classroom.

Answers

Show the answers of 1 and 2 to your teacher.

3. (a) $x = 3$ (b) $y = 15$ (c) $z = 1$ (d) $x = 2$ (e) $x = o$ (f) $y = 8$
(g) $y = 12$ (h) $x = 11$ (i) $y = 16$ (j) $x = 4$ (k) $z = 4$

13.2 Equation and equal axioms

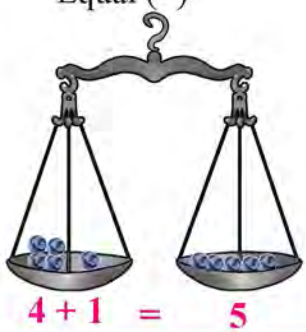
Write 3 open mathematical statements and discuss the following questions and present in the classroom:

(a) What are the variables and constants in the mathematical open statements?

(b) What will be the values of the variables in each open statement to make the statements true?

(c) Which sign has been used to connect left and right sides of each open statement?

Equal (=)



Not equal (≠)

Open mathematical statement connected with equal sign (=) to algebraic expressions is called an equation. In an equation, the value of variables is calculated from variable and constants. This makes each open mathematical statement true. In an equation x + 2 = 5, when x = 3, then, the open statement becomes true. Thus, the solution to x + 2 = 5, is x = 3.

Example 1

Solve:

1. (a) $x + 5 = 12$ (b) $3x = 18$

Solution:

(a) Given, $x + 5 = 12$ … … … (i)

The equation (i) is true if $x = 7$.

Therefore, $x = 7$

(b) Given, $3x = 18$ … … … (i)

The equation (i) is true if $x = 6$.

Therefore, $x = 6$

Activity 2

Discuss the following questions using beam balance as shown in the figure below and conclude:

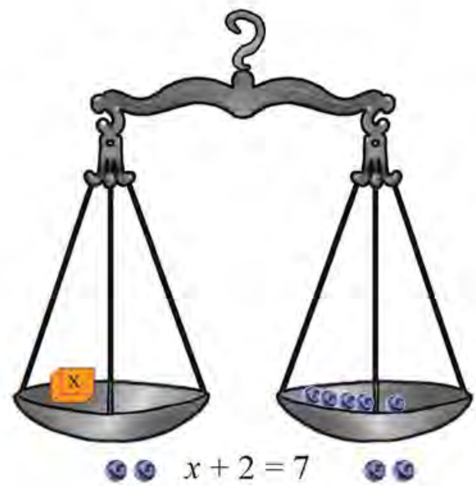
(a) Is the first beam balance with x weight and 2 marbles on the left side and 7 marbles on the right side balanced? Write its open mathematical sentence.

(b) Is the beam balance balanced if two marbles from each side of the beam balance taken out?

(c) If 1 marble is drawn from right side and 2 marbles are drawn from left side, how will the balance of beam balance be?

(d) If two marbles are added on both sides of the beam balance, how will the balance of beam balance be?

$x + 2 = 7$



$x + 2 = 7$

-2 -2

Beam balance is balanced when equal quantity is added to or drawn from the both sides of it.

Equality axioms

Equality axiom of addition: When equal quantities are added to the both sides of the equal quantities, the resulting quantities are also equal.

Equality axiom of subtraction: When equal quantities are subtracted from the both sides of the equal quantities, the resulting quantities are also equal.

Equality axiom of multiplication: When both sides of the equal quantities are multiplied by equal quantities, the resulting quantities are also equal.

Equality axiom of division: When both sides of the equal quantities are divided by equal quantities, the resulting quantities are also equal.

Equality axiom of addition

Example 2

Solve : $x - 3 = 5$

Solution:

Here, $x - 3 = 5$

or, $x - 3 + 3 = 5 + 3$

$\therefore x = 8$

Equal quantities are added to both sides of equal quantities.

Equality axiom of subtraction

Example 3

Solve : $x + 2 = 9$

Solution:

Here, $x + 2 = 9$

or, $x + 2 - 2 = 9 - 2$

$\therefore x = 7$

Equal quantities are subtracted from both sides of equal quantities.

Equality axiom of multiplication

Example 4

Solve : $\frac{x}{3} = 3$

Solution:

Here, $\frac{x}{3} = 3$

or, $\frac{x}{3} \times 3 = 3 \times 3$

$\therefore x = 9$

Both sides of equal quantities are multiplied by equal quantities.

Equality axiom of division

Example 5

Solve : 7x = 49

Solution:

Here, $7x = 49$

or, $\frac{7x}{7} = \frac{49}{7}$

$\therefore x = 7$

Both sides of equal quantities are divided by equal quantities.

Example 6

Solve: 5x + 3 = 18

Solution:

Here, $5x + 3 = 18$

or, $5x + 3 - 3 = 18 - 3$ (Why?)

or, $5x = 15$

or, $\frac{5x}{5} = \frac{15}{5}$ (Why?)

$\therefore x = 3$

Example 7

If 4 is added to 3 times of a number, the sum is 22; what is the number? Find.

Solution:

Let the required number be x.

According to the question,

$3x + 4 = 22$

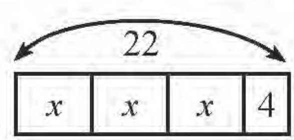
or, $3x + 4 - 4 = 22 - 4$ (Why?)

or, $3x = 18$

or, $\frac{3x}{3} = \frac{18}{3}$ (Why?)

$\therefore x = 6$

Model drawing method



$3x = 22 - 4$

$x = \frac{18}{3} = 6$

Exercise 13.2

1. **Solve each of the equations given below by using equality axiom:**

(a) $x + 4 = 5$ (b) $u + 2 = 8$ (c) $x - 9 = 1$ (d) $q - 5 = 9$

(e) $10 - x = 3$ (f) $13 - x = 2$ (g) $3x = 12$ (h) $9x + 2 = 20$

(i) $11x - 3 = 41$ (j) $\frac{r}{2} = 5$ (k) $\frac{z}{6} = 4$ (l) $\frac{x}{5} + 1 = 8$

(n) $\frac{y}{4} - 3 = 1$ (o) $\frac{48}{x} = 12$ (p) $27 - 2m = 3$ (q) $\frac{8}{x} + 3 = 7$

2. **Make an equation in each of the conditions given below and solve:**

(a) If x is added to 2, the sum is 7.

(b) If 5 is added to s, the sum is 9.

(c) If 3 is subtracted from y, the remainder is 7.

(d) If z is subtracted from 15, the remainder is 11.

(e) If x is multiplied by 3, the product is 18.

(f) If k is multiplied by 2 and 5 is added to it, the sum is 21.

(g) If x is divided by 6, the quotient is 6.

(h) If y is divided by 9 and 5 is added to it, the sum is 12.

(i) If 7 is added to one third of x, the sum is 25.

(j) If 3 is subtracted from one fourth of x, the remainder is 2.

3. **Jagannath's mother had given him double of the amount of what he possessed. If Jagannath had altogether Rs. 75, how much was given to him by his mother?**

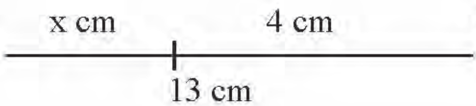
4. **Santosh's has two friends. Each of them had given him a packet of chocolates on his birthday. When his father added 5 chocolates, Santosh had 35 chocolates; how many chocolates were there in a packet?**

5. **If Khados's monthly expenditure and saving are Rs. 16,500 and Rs. 12,500 respectively, what is his income?**

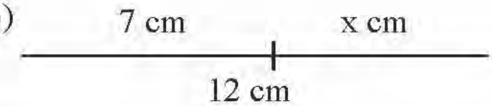
6. **Pramila has 25 pencils. After keshav has given her one third of his pencils, she has 50 pencils. How many pencils does Keshav at the beginning?**

7. **Make an equation in each of the conditions given below and find the value of x:**

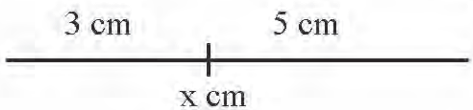
(a)



(b)



(c)



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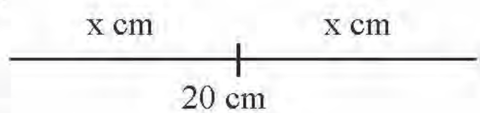
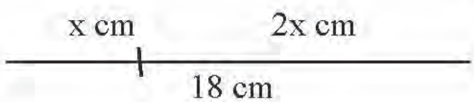
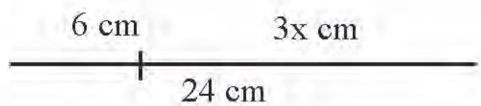


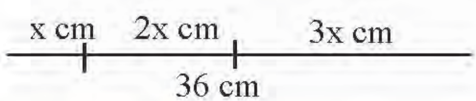
(e)



(f)



(g)



Answers

1. (a) 1 (b) 6 (c) 10 (d) 14 (e) 7 (f) 11
   (g) 4 (h) 2 (i) 4 (j) 10 (k) 24 (l) 35
   (m) 16 (n) 4 (o) 12 (p) 2
2. (a) 5 (b) 4 (c) 10 (d) 4 (e) 6 (f) 8
   (g) 36 (h) 63 (i) 54 (j) 20
3. 25
4. 15
5. 29,000
6. 75
7. (a) $x = 9$ (b) $x = 5$ (c) $x = 8$ (d) $x = 10$
   (e) $x = 6$ (f) $x = 6$ (g) $x = 6$

13.3 Trichotomy laws

Activity 3

Write a number and write five of its predecessors and successors on each side. What is the relation of the number with five of its predecessors and successors; greater, smaller or equal? Write by using the sign of greater than, smaller than or equal to.

There are three relations "greater than (>), equal to (=) or smaller than (<)" between any two numbers. This rule is called trichotomy law. If a and b are two numbers, there are three relations between these two numbers: (a) $a > b$, (b) $a = b$ or (c) $a < b$, where (a) and (c) are inequalities and (b) is equality relation.

Example 1

Fill up with an appropriate sign <, > or = in the given boxes:

(a) $3 \boxed{} 2$ (b) $5 \boxed{} 7$ (c) $-6 \boxed{} 2$ (d) $3 + 4 \boxed{} 7$

(e) $11 \boxed{} 15 - 2$ (f) $-5 \boxed{} -7$ (g) $-6 \boxed{} 2 - 5$

Solution:

(a) $3 \boxed{>} 2$ (b) $5 \boxed{<} 7$ (c) $-6 \boxed{<} 2$ (d) $3 + 4 = 7$

(e) $11 \boxed{<} 15 - 2$ (f) $-5 \boxed{>} -7$ (g) $-6 \boxed{<} 2 - 5$

Example 2

Write the statements given below with an appropriate sign of trichotomy <, > or = :

(a) x is lesser than 5. (b) $x - 3$ is greater than 4.

(c) x is greater than or equal to -2.

Solution:

(a) $x < 5$ (b) $4 < x - 3$ (c) $x \geq -2$

Exercise 13.3

1. **Categorize the triconotomy statements given below into: true or false:**

(a) $5 < 3$ (b) $7 < 9$ (c) $-4 > 3$ (d) $8 < -12$ (e) $-18 = -18$

(f) $7 + 2 > 9$ (g) $11=11+0$ (h) $1 \neq -5$ (i) $-6 > -2$

(j) $-7 < -8$ (k) $1 = -5 + 6$ (l) $-9 \angle -3$

2. Write the statements given below with an appropriate sign of trichotomy; <, > or = :

(a) x is lesser than 5. (b) x - 3 is greater than 4.

(c) x is greater than or equal to – 2. (d) -12 is smaller than 7.

(e) - 1 and - 1 are equal. (f) x - 7 is smaller than or equal to 5.

(g) - 1 is greater than - 3. (h) - 12 is not equal to – 13.

(i) - 13 is not less than y.

Project work

Find the weight of members of your family and compare them with each other by using trichotomy laws. Discuss with friends the relation of comparative chart and present a report in classroom.

Answers

Show all the answers to your teacher.

Miscellaneous exercise

1. Simplify:

(a) $(5p + 6p - 10p)$ (b) $8a - 9a + 12a$ (c) $3x^2 + 5x^2 - 6x^2$

(d) $(a^2 + ab + b^2) - (a^2 - ab + b^2)$

(e) $(2p^2 + 3pq + 4q^2) + (3p^2 + 2pq + q^2)$

(f) $(4ab + 5bc - 6ac) - (ab + 2bc + 3ac)$

(g) $(7a^2b + 6b^2c + 5c^2a) - (2a^2b + 3b^2c + 4c^2a)$

2. Multiply:

(a) $4a \times 5a$ (b) $14x^2y \times 5xy$ (c) $11a^2b \times 8b^2c \times 5c^2a$

(d) $2a^2 \times (3bc + 4ac)$ (e) $4x^3y \times (5x^2y + 6xz^2)$

(f) $13p^3q^2 \times (2p^2q - 3pq^2)$ (g) $7a^3 \times (5a^2 + 7ab^2 + 9c^2)$

3. Divide:

(a) $6b^3cd \div 2bcd$ (b) $33x^3y^2z \div 11x^2y^2z$

(c) $(a^2x^2 + a^2x) \div ax$ (d) $(46a^3b^4c^5 - 69a^4b^5c^6) \div 23a^2b^3c^4$

(e) $(27m^7n^9p^8 - 36m^5n^7p^6) \div 9m^3n^4p^5$

4. **The area of a rectangular garden is $28x^4y^3z$ square meter. If the length of the garden is $4x^2yz$ meter, what is its breadth? Find.**

5. **The area of a rectangular swimming pool is $24x^3y^2 - 16x^2y$. If the breadth of the swimming pool is $8xy$, what is its length? Find.**

6. **If a = 3, b = 2 and c = -1, find the value of expressions given below.**

   (a) $ab + bc$ (b) $a^2 + b^2$ (c) $2a^2 + b^2 + c^2$

   (d) $a^2 + 2ab - c^2$ (e) $\frac{b^2-2bc-c^2}{a+b}$ (f) $\frac{a^3+3b^2c+c^3}{a^2+c^2}$

7. **Solve each of the equations given below using equality axioms:**

   (a) $x - 6 = 9$ (b) $s + 7 = -7$ (c) $3x - 8 = 1$ (d) $2 - x = -4$

   (e) $9 - 2x = 13$ (f) $\frac{3x}{7} = 9$ (g) $\frac{y}{8} - 21 = -18$ (h) $\frac{75}{z} - 8 = 7$

8. **Make an equation in each of the conditions given below and solve:**

   (a) If 7 is added to x, the sum is 15.

   (b) If 0 is subtracted from y, the remainder is – 4.

   (c) If x is subtracted from 11, the remainder is 1.

   (d) If s is multiplied by 6, the product is 72.

   (e) If 9 is subtracted from the product of 3 and x, the remainder is 21.

   (f) If y is divided by 9, the quotient is -7.

9. **Put an appropriate sign of trichotomy <, > or = :**

   1. (a) $7 \boxed{} 2$ (b) $-14 \boxed{} -13$ (c) $5 + 1 \boxed{} -5 - 1$

      (d) $-8 + 1 \boxed{} -3 -4$ (e) The sum of x and 3 is lesser than 8.

      (f) The difference of 5 from y is lesser than 9.

Answers

Show all the answers to your teacher.

Unit Five | Geometry

Lesson 14

Lines and Angles

14.0 Review

What types of lines are called straight lines and curve lines?

What is the difference between line and line segment? Discuss.

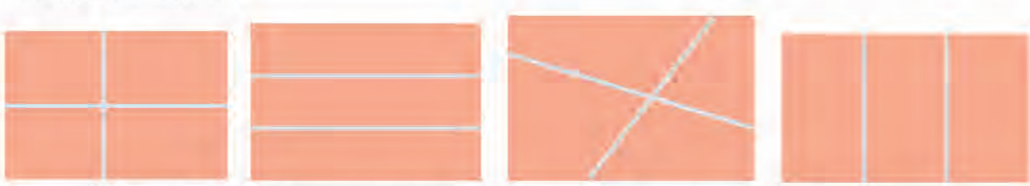
14.1 Pair of lines

Intersected and perpendicular lines

Intersecting line

Activity 1

Divide all students of the class into four groups, take a blank paper or a page of a note copy and fold each of them two times in four different ways as shown in the given figure:



Draw a line with the help of a pen or pencil along the folded part. Observe all the lines and answer the following questions.

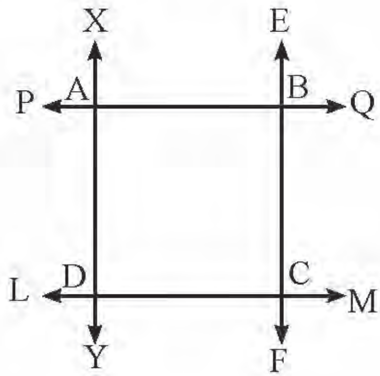
(a) How many lines are drawn in total?

(b) Are the lines mutually intersected or not?

(c) What type of lines are these pair? Discuss within the groups and present your conclusion in the classroom.

Activity 2

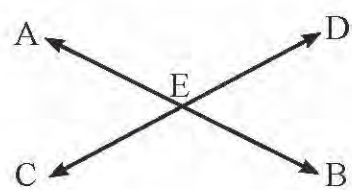
Observe the given figure. Discuss in groups and find the answer of the following questions. Prepare the conclusion with the help of a teacher and present them in the classroom.



(a) Which lines are intersected mutually?

(b) Which lines are not intersected mutually?

If two straight lines cut each other at a point then they are called the intersecting lines. For example, in the given figure , the straight lines AB and CD are intersected at the point E. So they are called intersecting lines.



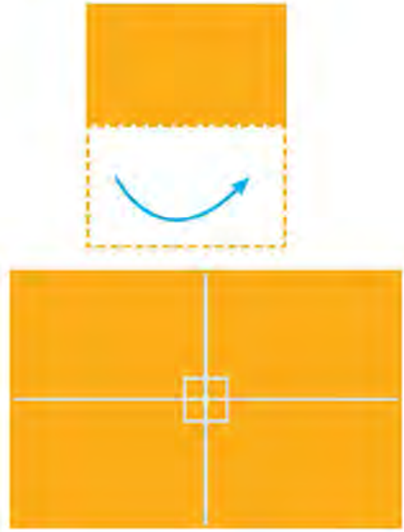
Perpendicular lines

Activity 3

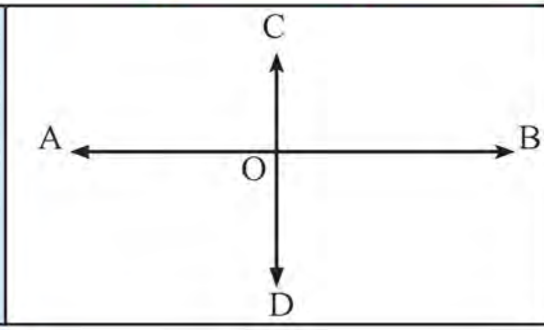
Take a rectangular piece of paper and fold it two times from the middle part as shown in the figure. Then after, open the folded paper and draw the lines along the folded part with the help of pencil and ruler.

Observe the figure obtained and discuss it with your adjacent friend. Find the answers of the following questions and present them in the classroom.

(a) How many angles are drawn in total?
(b) What is the measurement of each angle in degree?
(c) What type of lines are these two lines?



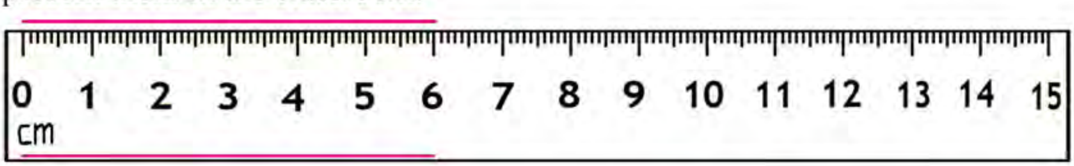
If two straight lines are intersected with each other making 90° angles then they are called the perpendicular lines. For example, in the figure AB and CD are perpendicular lines. They are written as AB⊥CD



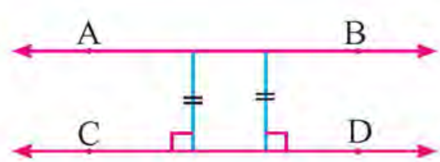
Parallel lines

Activity 4

Using ruler and pencil, everybody draw the line segments along both sides of the ruler as shown in the figure. Observe the figure obtained and discuss it within the groups and find out the answer of the following questions and present them in the classroom.



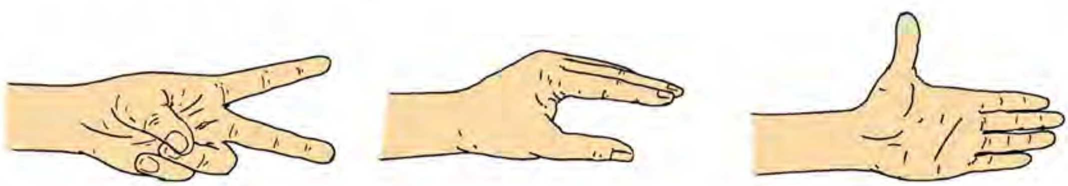
(a) Do both of the line segments intersect each other while producing or not?
(b) Do the perpendicular distances between these line segments everywhere same?



If two straight lines never meet each other even after extending them up to infinity in bothside then they are called parallel lines. For example, in the figure, AB and CD are parallel lines. They are written as AB//CD.

Activity 5

Observe the given figures and discuss with your friends about what type of lines are formed by the fingers.

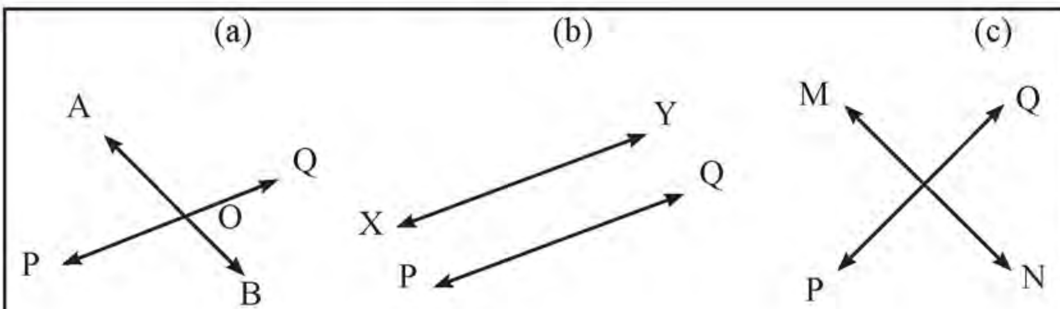


Activity 6

Observe the benches, desks, chairs, windows, railings of the veranda, walls and other objects of the classroom. Then after, make the list of parallel, intersecting and perpendicular lines; discuss them within the groups and present in the classroom.

Example 1

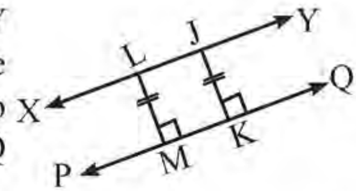
Identify the given pairs of lines. Why?



Solution:

(a) In this figure, the straight lines AB and PQ are intersected at the point O. So they are the intersecting lines.

(b) In the second figure, the straight lines XY and PQ are not intersected at any point. The perpendicular distance between them is also equal. Therefore, the straight lines XY and PQ are parallel lines.

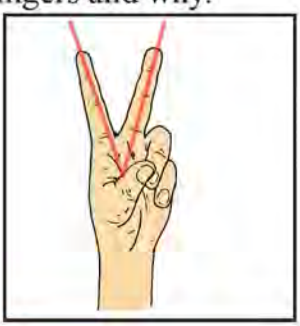


(c) In the third figure, the straight lines MN and PQ, are intersected at point O. So they are intersecting lines.

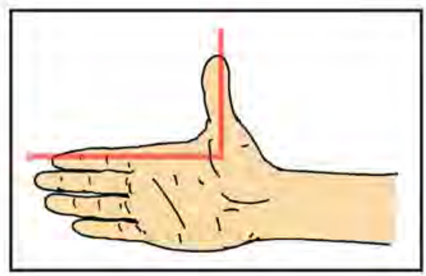
Example 2

With the help of a protractor, measure the angles between the fingers in the given picture and find, what type of pair of line segments are represented by these fingers and why.

(a)



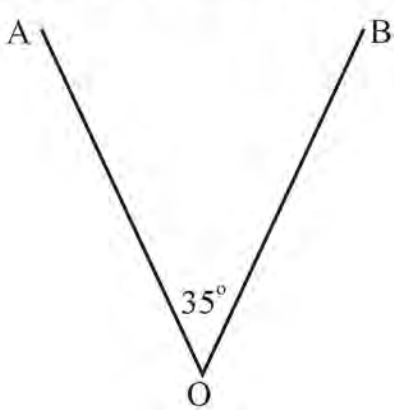
(b)



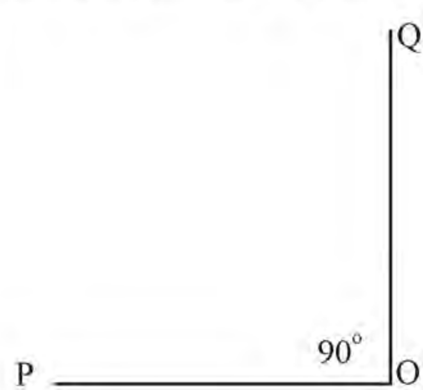
Solution:

Draw the angles by using the straight lines which are equal to the angles between the above fingers respectively as shown in the following figures.

(a)



(b)

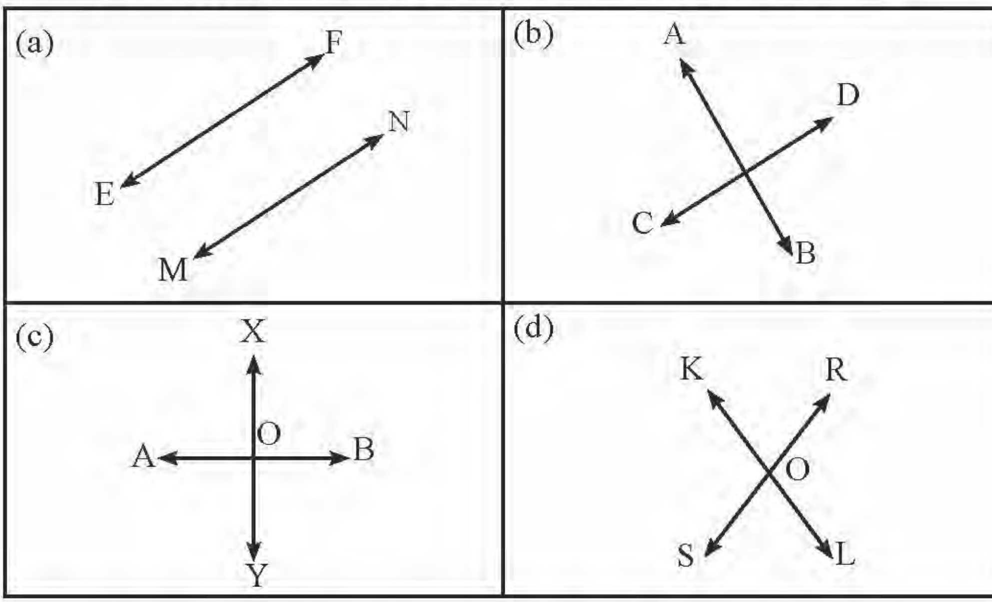


(a) In this figure, the straight lines AO and BO are joined at O making the angle $\angle AOB = 35^\circ$. So the angle between the index finger and middle finger is 35°. The straight lines represented by these two fingers meet each other at O. That is why they represent the intersecting lines.

(b) In the second, the straight lines PO and QO meet each other at the point O. The angle made by these lines is $\angle POQ = 90^\circ$. So, PO and QO are perpendicular to each other. Therefore, the angle between the thumb and pointing finger is 90° and it represent the perpendicular lines.

Exercise 14.1

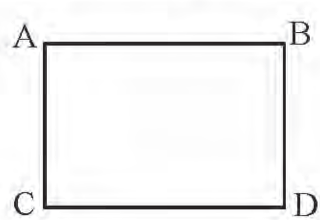
1. Identify and recognize the type of the following pairs of lines.



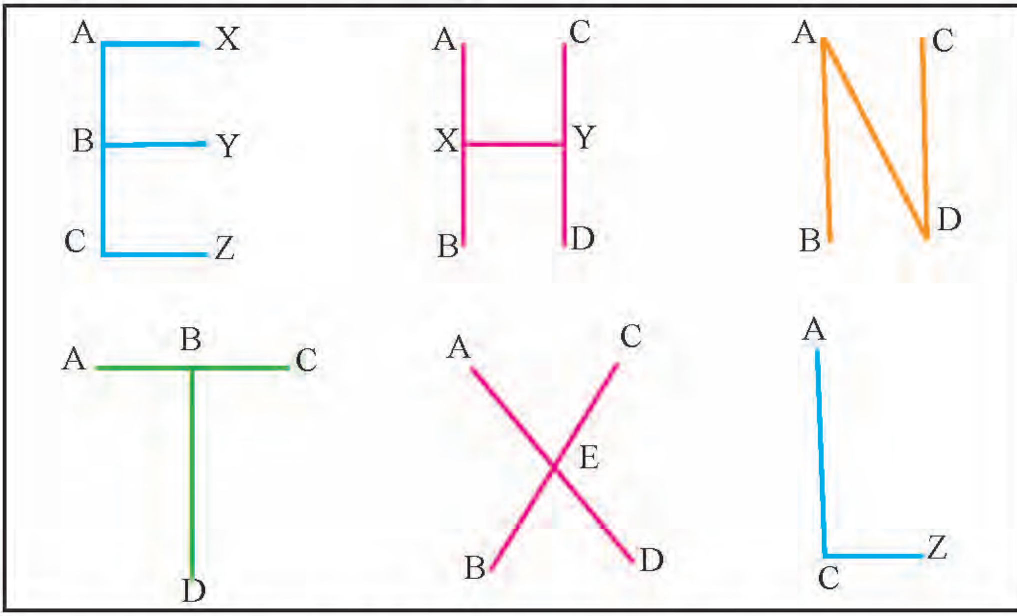
2. Observe the adjoining figure and answer the following questions.

(a) What type of line segments are AB and CD? Why?

(b) What type of line segments are AC and CD ? Why?



3. **Identify and write the names of the intersecting, perpendicular and parallel lines in the English alphabets given below:**



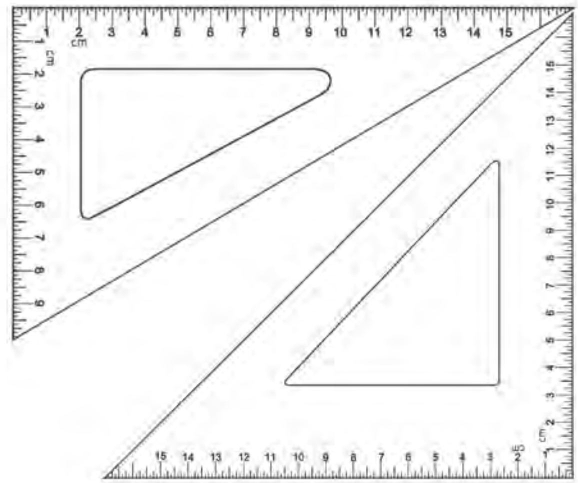
4. **Observe the shapes of the pairs of lines made by the positions of the hands while parading in the school premise. Prepare a short document in a group with the model figures and present it in the classroom**

Project Work

Divide all students into the five groups. Each group go to the nearby religious places, public huts and gathering sites to observe the various structures. Write the names with figures of the intersecting, perpendicular and parallel parts seen in the ceilings, beams, gates and windows of the houses and other structures and present this project work in the classroom.

14.2 Construction of parallel and perpendicular lines by using set squares

Inside a student-geometry box, there are two triangular tools of plastic pieces where some of the inner triangular parts are removed. These are called the set squares. In one of the set squares, there is one 90° and other two angles of 45°. It is called 45° set square. Similarly, in another set square, there are 30°, 60° and 90°angles. It is called 30° and 60° set square.



Construction of parallel lines by using the set squares

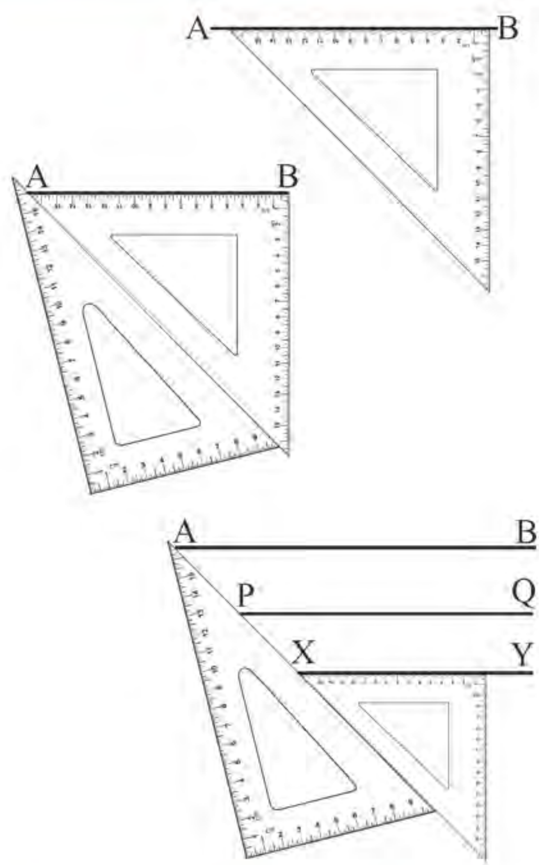
Construction of Parallel Lines

Activity 1

(a) Draw a line segment AB first. Place one edge of the 45°-set square over the line AB.

(b) Then after, put another set square with 30° angle upwards by joining the edges of both set-squares opposite to the right angles firmly as shown in the figure.

(c) Now, shift the 45°-set square downwards by pressing the 30°-set square firmly and draw the required parallel lines as shown in the figure. In the given figure, the lines PQ and XY are parallel to AB.



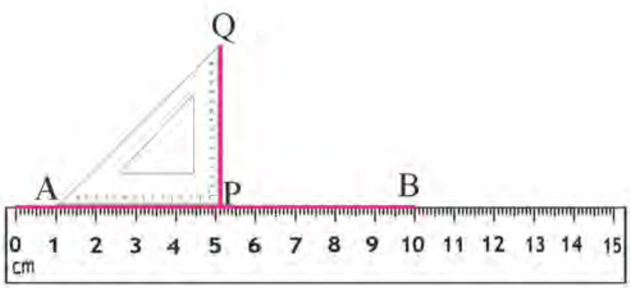
Construction of Perpendicular Lines by using the set Squares

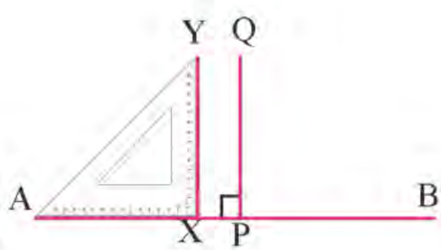
Construction of Perpendicular Lines

Activity 2

(a) Draw a straight line segment AB. Place one edge of the ruler over the line AB.

(b) Then after, place one edge of the set square with 90° angle right above the edge of ruler at the point P and draw the line PQ as shown in the figure. Now, shift the set square forward or backward and draw the perpendicular lines as required. In the given figure, the lines PQ and XY are perpendicular to the line AB.





Exercise 14.2

1. Draw the following straight line segments on your copy. Draw a line segment parallel to each line segments by using the set-squares.

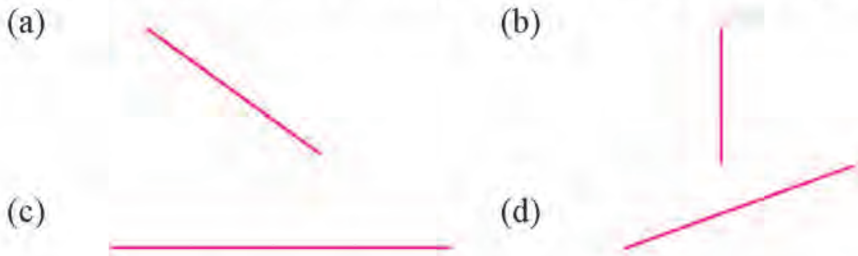
(a)

(b)

(c)

(d)

2. **Copy the straight line segments given below. Draw the line segments perpendicular to these line segments by using the set-squares.**



3. **With the help of a ruler, draw the line segments having the following measurements. Use set square to draw one parallel line in each.**

   (a) AB = 5 cm (b) XY = 8 cm

   (c) CD = 10 cm (d) MN = 7 cm

4. **With the help of a ruler, draw the line segments according to the measurements given below. Draw a line segment perpendicular to each of them by using the set- squares.**

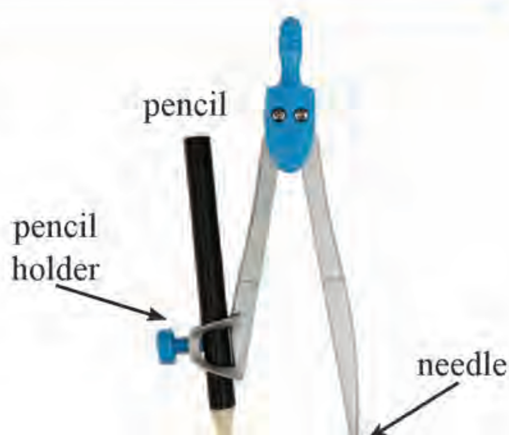
   (a) PQ = 7 cm (b) ST = 12 cm

   (c) CD = 8 cm (d) GH = 9 cm

14.3 Construction of bisector of a line segment by using a compass

Observe the figure and know about the various parts of your compass. A compass is used to draw the various geometrical figures.

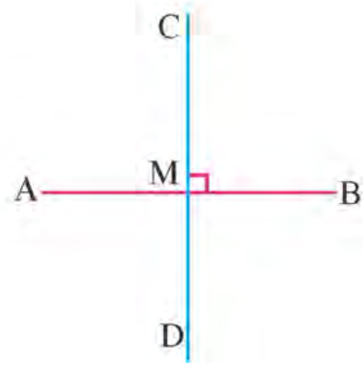
[Write the name of the parts of the compass as: (1) pencil (2) pencil holder (hold for a pencil) (3) pointer (needle) in the above figure]



Perpendicular Bisector of a Line Segment

Activity 1

In the adjoining figure, measure the $\angle AMC$ and $\angle CMB$ using the protractor and the line segments AM and MB using the ruler. Then after, find the answers of the following questions discussing group and present them in the classroom.



(a) AB and CD are intersected at the point M now find the relation between AB and M.

(b) What is the relation between the line segments AB and CD?

Conclusion: The point M has divided the line segment AB into two equal parts and AB and CD are perpendicular to each other. So the line segment CD is the perpendicular bisector of the line segment AB.

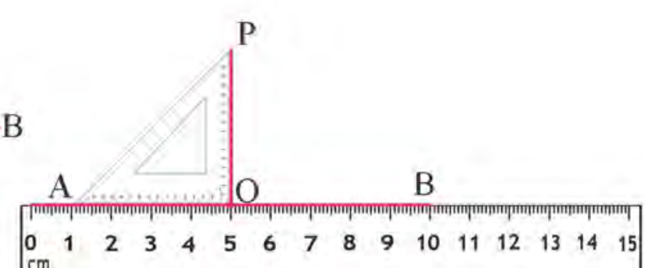
Activity2

How to draw a perpendicular bisector?

(A) Using the ruler and set squares

(i) Draw a straight line segment AB =10 cm and mark O at its mid-point.

(ii) Draw a perpendicular line segment PO by using the ruler and the 45° set square as in the figure. Now, PO is the perpendicular bisector of AB.

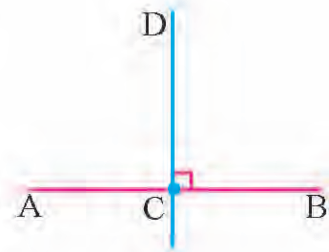


(B) Using a ruler and protractor

(i) Draw a line segment AB = 10 cm by using the ruler.

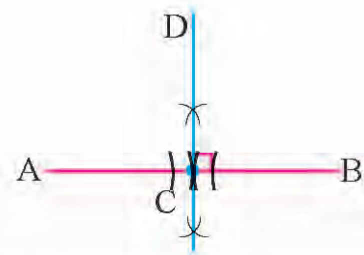
(ii) Mark C in the line AB measuring 5 cm with the help of ruler.

(iii) Draw 90° angle at the point C by using the protractor. Here, AC = CB = 5 cm and ∠ACD=90°. So CD is the perpendicular bisector of AB.



Activity 3

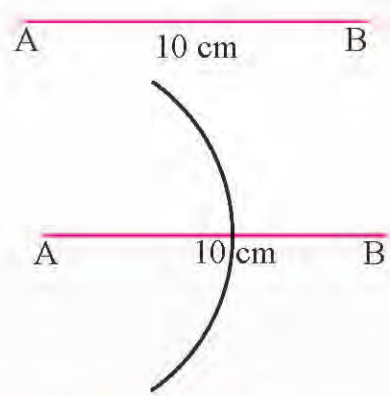
In the figure of activity 2 (B), take arcs of radi 4.5 cm, 5 cm and 6.5 cm from the points A and B on both sides of AB. Discuss this activity with your friend and come to a conclusion.



Conclusion: The arcs taken from the end points of a line segment, whose perpendicular bisector is to be drawn do not cut each other if their radii are less than half of that line segment. Therefore, *the perpendicular bisector of a line segment can be drawn by taking the arcs of radi is greater than half of the length of that line segment from both ends on its both sides.*

(C) By using a compass

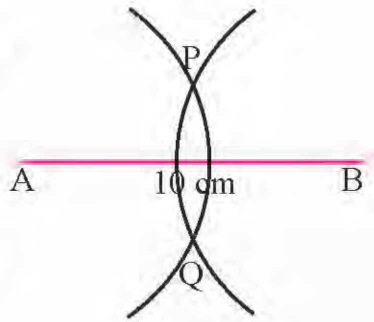
Read the following process and draw the perpendicular bisector of a line segment accordingly.



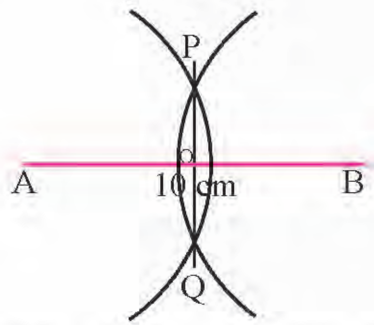
(i) Draw a line segment AB = 10 cm.

(ii) Place the needle of a compass at the point A and take a long arc of radius greater than 5 cm on both sides of AB.

(iii) Similarly, take a long arc of radius greater than 5 cm from the point B on both sides of AB.



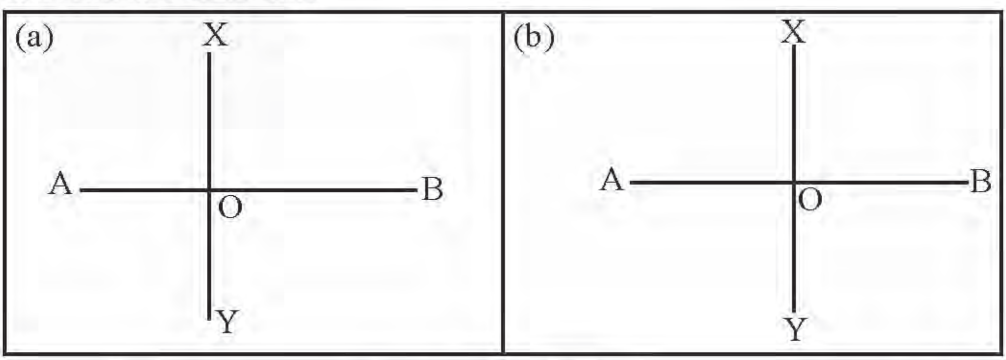
(iv) Mark the points at which both of the arcs cut each other by using P and Q respectively and join with the help of ruler.



(v) Mark the point of intersection of AB and PQ by O. Now, PQ is the perpendicular bisector of AB.

Exercise 14.3

1. In the figures given below, find, whether XY is the perpendicular bisector of AB or not.



2. Draw the line segments having the following measurements using the ruler and also draw a perpendicular bisector of each of them using the compass:

(a) PQ = 7 cm (b) ST = 12 cm (c) CD = 8 cm

(d) GH = 9 cm (e) XY = 5 inch (f) PQ = 4.5 inch

3. Draw a line segment AB = 12 cm. Guess the mid-point of AB and mark and name it O. Draw a line perpendicular to AB at O. Test by measuring whether that perpendicular line is the perpendicular bisector of AB or not.

Project Work

Prepare a model of perpendicular bisectors using various wooden materials like small pieces of bamboo, nana bamboo branches or sticks on the chart paper, cardboard, tracing paper or in any other convenient way and present it in the classroom.

Answers

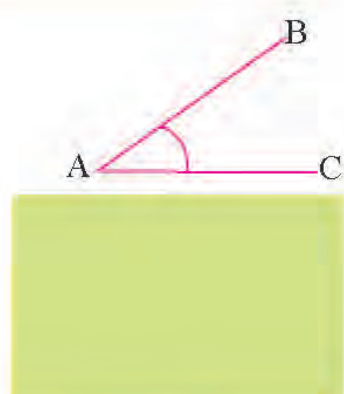
Show all the answers to your teacher.

14.4 Classification of angles

Take a pair of Meccano strips and join them at one end and rotate or widen their other ends apart. Observe the shapes of the angles made by all friends in this way. Discuss in groups about the types of angles so formed at different time and positions.

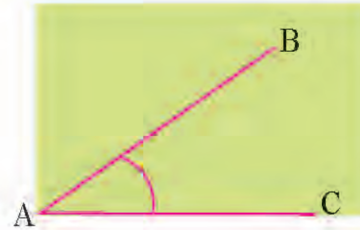
14.4.1 Right angle, acute angle and obtuse angle

Activity 1



Every student draw an angle different from each other. Everybody take a transparent rectangular piece of paper. Place the vertex and base of one of its vertical angles over the vertex and base of the angle that you have just drawn as shown in the figure.

Now, see the other side of the angle drawn by you and write, whether it is inside or outside of the transparent paper.



Now, discuss with your friends and write, whether the angle drawn by you is the acute angle, right angle or obtuse angle. The given figure, $\angle BAC$, lies inside of the transparent paper. So, $\angle BAC$ is the acute angle.

Activity 2

Make groups of three students each. Now each group draw an angle by using the ruler and pencil looking different from each other as shown in the figure.

Exchange each other's angles that you have drawn among the groups. Measure the angles with the help of a protractor and write their values like $\angle ABC=45^\circ$, $\angle PQR= 90^\circ$ and $\angle XYZ=120^\circ$. Is the value of your angle greater than 90° or less than 90° or equal to 90°? Observe it.

If that angle is equal to 90° then it is the right angle;

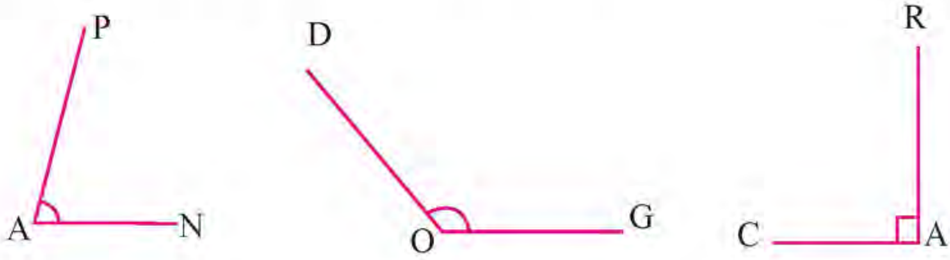
If it is greater than 0° and less than 90° then it is the acute angle and

If it is greater than 90° and less than 180° then it is the obtuse angle.

The angle whose measure is 90° is called a right angle. The angle greater than 0° and less than 90° is called an acute angle. The angle greater than 90° and less than 180° is called an obtuse angle.

Example 1

Measure the given angles with the help of a protractor and distinguish whether it is the acute or right or obtuse angle.



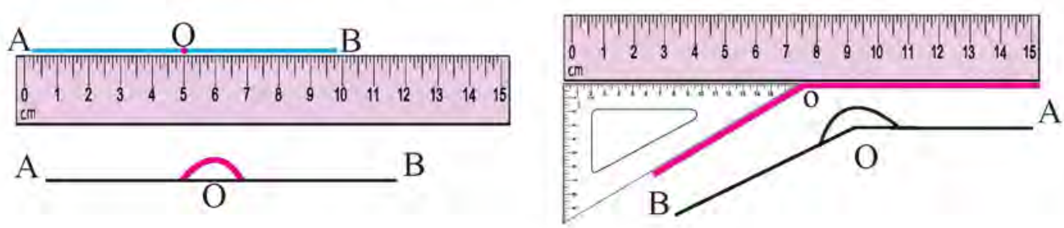
Solution:

Solution: Here, ∠PAN = 75°. So it is the acute angle. ∠DOG = 130°. So it is the obtuse angle. ∠RAC = 90°. So it is the right angle.

Straight angle and reflex angle

Activity 3

Draw the angles as shown in the figure:



What type of angles are formed? Discuss with the friends.

The measurement of the angle in the above first figure is 180°. Similarly, the measurement of the angle in the second figure is greater than 180°.

Activity 4

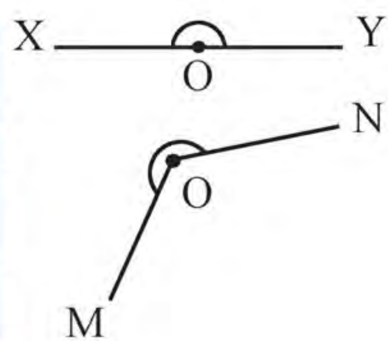
Sit in the groups consisting of four students in each and take a clock or model of a clock.

Adjust the needles of that clock indicating the different times as shown in the figure. First, guess the values of the angles made by the hour and minute needles on the both sides and then measure them with the help of a protractor. What difference did you get in their measurements? Discuss in groups and find out the conclusion.

Now, find out whether these angles are less than or equal to or greater than 180°. Present the result in the classroom.

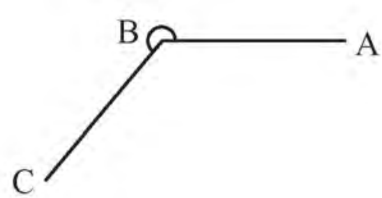
If the measurement of any angle is equal to 180° then it is called a straight angle. Similarly, if the measurement of any angle is greater than 180° and less than 360° then It is called a reflex angle.

In the given figures, $\angle XOY$ is the straight angle and $\angle MON$ is the reflex angle.



Measurement of a reflex angle:

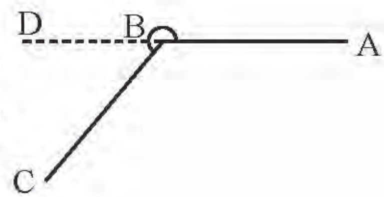
The protractor that we use can measure the angles from 0° to 180° easily. But can you guess how to measure the angles greater than 180° ?



Method one:

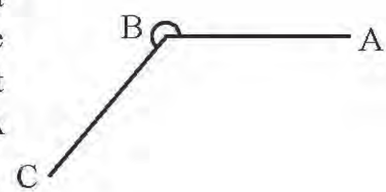
(i) Produce the base line segment AB up to D.

(ii) Now $\angle DBA = 180^\circ$. Measure $\angle CBD$ by using a protractor and add it to 180°. In the given figure, reflex $\angle CBA = 180^\circ + 50^\circ = 230^\circ$.



Method two:

(i) The total angle formed at the centre of a circle is 360°. So measure the obtuse angle $\angle ABC$ as shown in the figure and subtract it from 360°. In the given figure, reflex $\angle CBA = 360^\circ - 130^\circ = 230^\circ$.



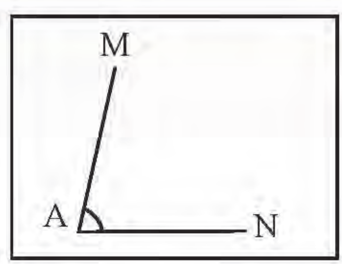
Activity 5

Observe the various objects situated inside the classroom and the houses situated at different places outside the classroom. Identify the acute, right, obtuse, straight and reflex angles situated on these objects and the parts of the houses. Prepare a table of those objects, houses and the places with the names of the above angles situated on them and present it in the classroom.

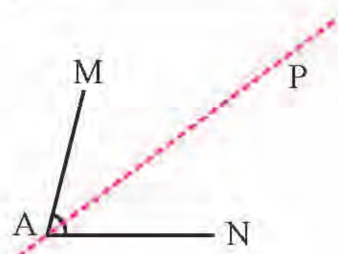
14.4.2 Construction of bisector of an angle

Method one: By folding a paper

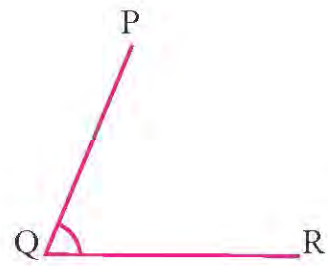
Draw an angle MAN on your copy. Cut off that angle with the help of the scissors.



From the vertex A of the angle fold the paper in such way as to overlap the arms AM and AN. Press the folded part and open it. Draw a line segment AP along the folded part by using a ruler. Now measure the angles $\angle MAP$ and $\angle NAP$ with the help of a protractor. You will get the measures of $\angle MAP$ and $\angle NAP$ equal. So, AP is the bisector of the angle $\angle MAN$.



Method two: By using a protractor

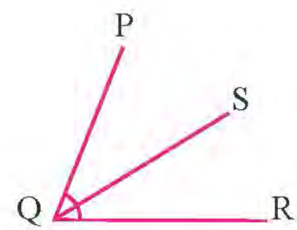


Draw an angle PQR and measure it by using the protractor.

For example, $\angle PQR = 70^\circ$.

Now divide 70° by 2 to get 35° i.e. $\frac{225}{2} = 35^\circ$.

Taking QR as the base, draw an angle of 35° at Q as in the figure $\angle RQS = 35^\circ$. What will be the measure of $\angle PQS$? Measure it. It is also 35°. So QS is the bisector of $\angle PQR$.



Method 3 : By using Ruler and Compass

Draw an angle ABC. Put the pointer of the compass at B and take the arcs on the arms AB and BC intersecting at the points D and E respectively as shown in the figure. Again, take the arcs of the same radii from the points D and E as

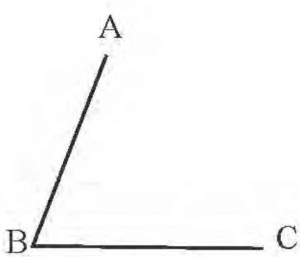


figure 1

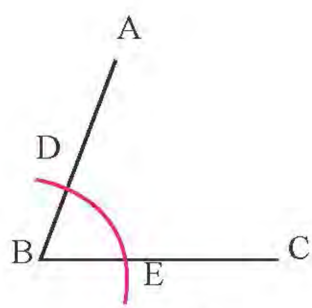


figure 2

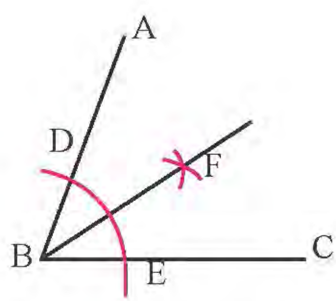


figure 3

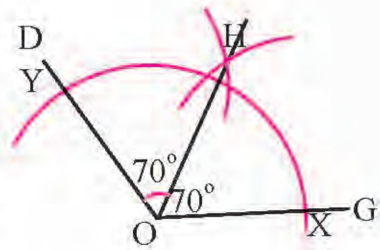
centres and mark their intersecting point by F as shown in the figure. Join the BF by using the ruler. Now, BF is the bisector of $\angle ABC$. Test by measuring the angles $\angle ABF$ and $\angle CBF$.

Example 1

Draw the bisector of the given angle by using the compass and ruler.

Solution:

Take the arcs with equal radii from the point O on the lines OG and OD intersecting at the points X and Y respectively. Similarly, take the arcs of equal radii from the points X and Y intersecting each other at the point H as shown in the figure. Join O and H. Now, ∠GOH and ∠DOH are equal. So OH is the bisector of ∠DOG.



Exercise 14.4

1. Fill in the blanks.

(a) In ∠ABC, …….. is a vertex ……… and ……. are the arms.

(b) One right angle is equal to ………….. degrees.

(c) Two right angles make ……… angle.

(d) The angle greater than straight angle and less than 360° is called …………..

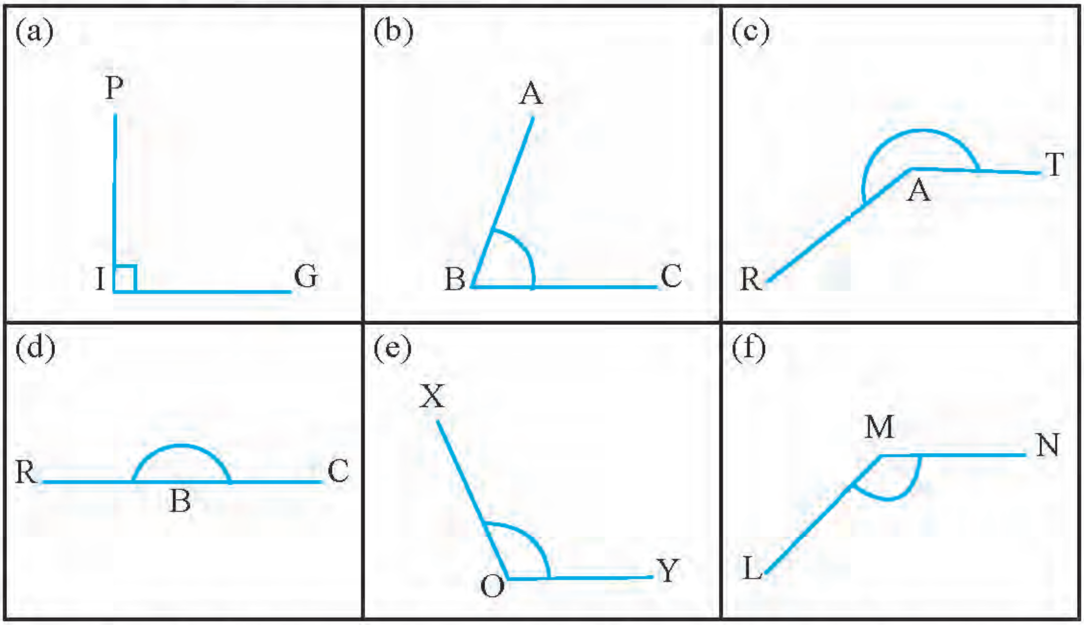
(e) The angle formed by the minute and hour needles of a clock at quarter to eleven is ……… angle.

2. Complete the following table with the given angles according to their types.

60°, 90°, 105°, 50°, 30°, 220°, 150°, 180°, 45°, 89°, 170°, 95°, 250°, 260°, 36°, 110°, 22°, 90°,

Acute angle	Right angle	Obtuse angle	Straight angle	Reflex angle

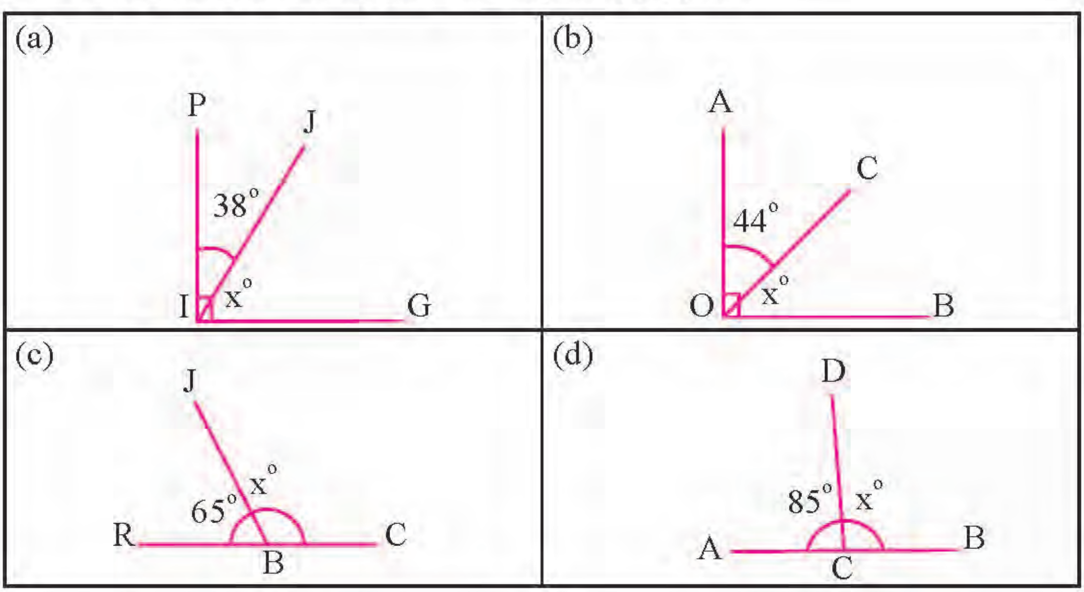
3. **Measure the angles below. Decide whether they are acute, right, obtuse, straight or reflex angles.**



4. **Draw the following angles and their bisectors by using the protractor and the compass respectively.**

(a) 50° (b) 60° (c) 100° (d) 140°

5. **Find the value of x from the following figures:**



6. **Draw the figures of the acute, right, obtuse, straight and reflex angles made by the minute and hour needles of a clock. Also write the time indicated by those figures.**

7. **In the following figure of a plough, write the names of the acute, right, obtuse, straight and reflex angles formed by the parallel, perpendicular or intersecting lines according as their types.**

Project Work

Prepare the models of the acute, right, obtuse, straight and reflex angles by using the straight bamboo pieces or sticks and present them in the classroom.

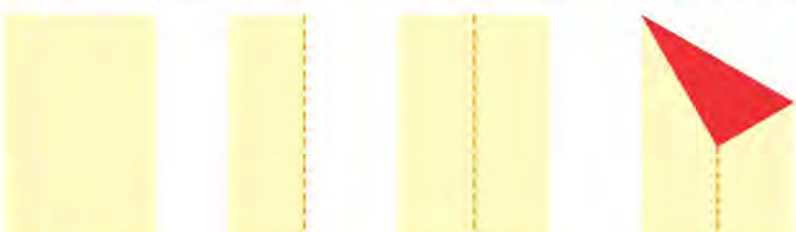
14.5 Construction of angles

Construction of 60°angle

(a) Folding a paper.

Take a rectangular piece of paper. Continue to fold it as shown in the figure. In how many places do you get the 60° angle? Discuss with your friends.

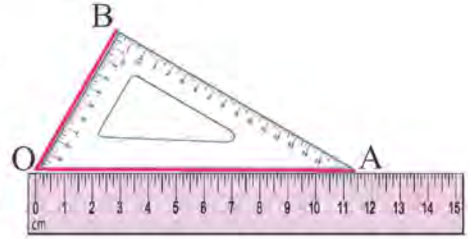
(i)



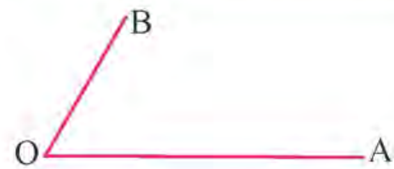
(ii)

(b) Using the set-squares

(i) Draw a line segment OA with the help of a ruler.

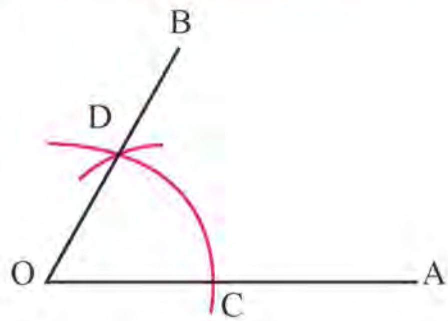


(ii) Place the vertex of the 60° angle of a $30^\circ/60^\circ$ set square at the point O of the base line OA and draw a line segment OB as shown in the figure. Now, $\angle AOB = 60^\circ$ is the required angle.



(c) Using the compass and ruler

(i) Draw a line segment OA with the help of a ruler.



(ii) Place the needle of the compass at the point O, take an arc on the line OA and mark the intersecting point by C as shown in the figure.

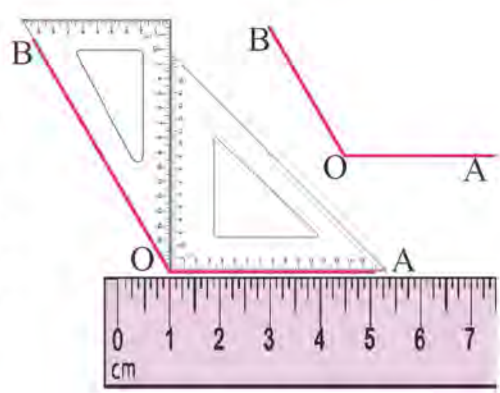
(iii) Take an arc having the same radius OC from the point C intersecting the first arc at the point D as in the figure. Now draw a line segment OB passing through O and D using a ruler.

(iv) Measure the angle $\angle AOB$ by using a protractor. Now, $\angle AOB = 60^\circ$ is the required angle.

Construction of 120° angle

(a) Using the set squares

(i) Draw a line segment OA by using a ruler.

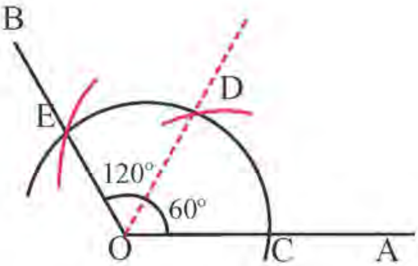


(ii) Place the vertices of the 90° and 30°angles of the both set squares at the point O of the base line OA and draw the line segment OB as shown in the figure. Now, $\angle AOB = 120^\circ$ is the required angle.

(b) Using a compass and ruler

(i) Draw a line segment OA using a ruler.

(ii) Take a long arcs from the point O on the line OA and mark that point by C at which the arc intersects OA as shown in the figure.



(iii) Take a second arc of the same radius from the point C intersecting the first arc at the point D.

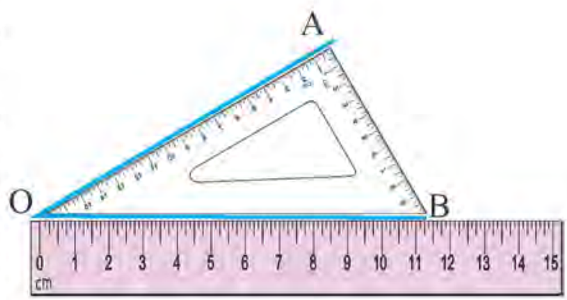
(iii) Again, take a third arc of the same radius from the point D intersecting the first arc at the point E. Lastly, draw a line segment OB passing through the points O and E. Now, $\angle AOB = 120°$is the required angle. What will be the value of $\angle BOD$?

Construction of 30° angle

(a) Using the set squares

(i) Draw a line segment OB by using the ruler.

(ii) Put the vertex of the 30° angle of a 30°/60° set square on the point O of the base line OB and draw a line segment OA as shown in the figure.

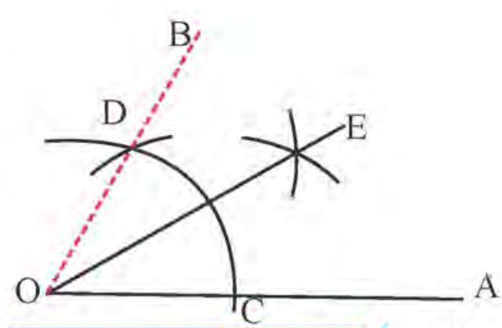


(iii) Now, $\angle AOB = 30°$

(b) Using the compass and ruler

(i) Draw a line segment OA with the help of a ruler.

(ii) Place the pointer of the compass at the point O and take an arc on the line



OA as shown in the figure. Mark that point by C at which the arc intersects OA.

(ii) Take the second arc of the same radius from the point C intersecting the first arc at the point D.

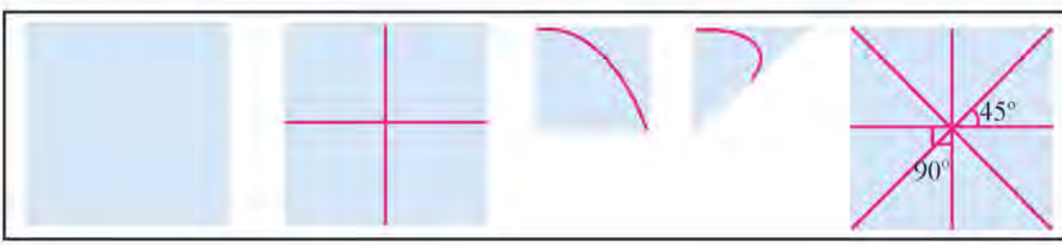
(iii) Again, take the arcs of the same radii from the points D and C intersecting each other at the point E. Join O and E by using a ruler. Measure the $\angle AOE$.

Now, $\angle AOE = 30°$. What will be the value of $\angle BOE$?

Construction of 90° angle

(a) Folding a paper

Take a rectangular piece of paper. Fold it from all sides in the middle. Again, fold it as shown in the fourth figure. Now, open it. You will see its shape as shown in the fifth figure. Draw the lines along the folded parts and observe the types and measurements of the angles so formed. Then after, measure them by using the protractor and discuss with your friends.

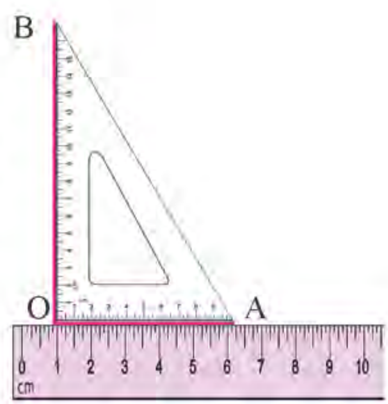


(b) Using set squares

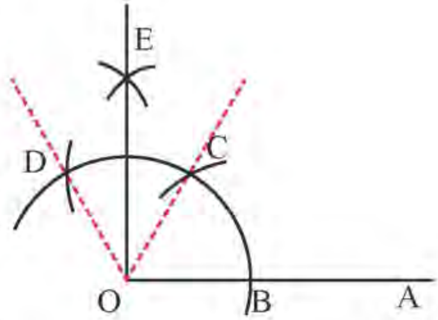
(i) Draw a line segment by using a ruler.

(ii) Place the vertex of the 90° angle of the set square at the point O of the base line OA and draw the line segment OB as shown in the figure.

(iii) Now, $\angle AOB = 90°$ is the required angle.



(c) Using compass and ruler



(i) Draw a line segment OA by using a ruler.

(ii) With O as the centre, take a long arc of a fixed radius to cut the base line OA at B as shown in the figure.

(iii) With B as the centre, take the second arc of the same radius to intersect the first arc at the point C.

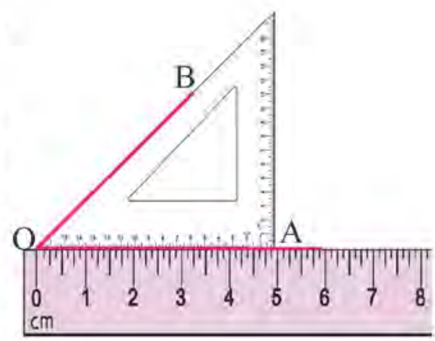
(iv) Again, take the third arc of the same radius from the point C to intersect the first arc at the point D.

(v) Similarly, take two arcs of same radii from the points C and D intersecting each other at the point E.

(vi) Draw a line segment OE by using a ruler. Measure $\angle AOE$ with help of a protractor. Now $\angle AOE=90°$ is the required angle. What will be the value of $\angle DOC$?

Construction of 45° angle

(a) Using a set square

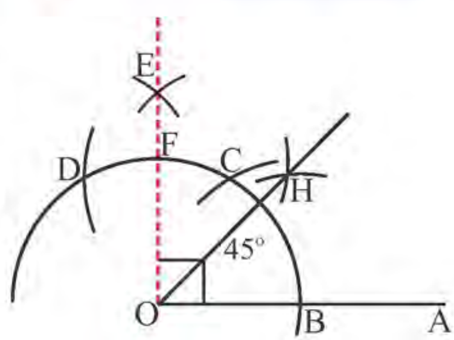


(i) Draw a line segment OA using a ruler.

(ii) Place the vertex of the 45° angle of a set square on the point O of the base line OA and draw a line segment OB.

(iii) Now, $\angle AOB=45°$ is the required angle.

(b) Using compass and ruler



(i) Draw a line segment OA using a ruler.

(ii) Take a long arc of some fixed radius from the point O on the line OA intersecting it at the point B as shown in the figure.

(iii) Take the second arc of the same radius from the point B intersecting the first arc and name it point C.

(iv) Take the third arc of the same radius from the point C intersecting the same first arc at point D.

(v) Again, take two arcs of equal radii from the points C and D intersecting each other at the poit E.

(vi) Draw a line segment OE by using a ruler. Let F be the point at which OE intersects the first arc.

(vii) Now, take two arcs of equal radii from the points F and B intersecting each other at the point H. (viii) By using the ruler, draw a line segment passing through O and H. Measure the $\angle AOH$ by using a protractor. Now $\angle AOH=45°$

Note: We can also draw 45° angle between 30° and 60° angles.

Exercise 14.5

1. Draw the angles below using the protractor:

(a) 45° (b) 50° (c) 65° (d) 100° (e) 70° (f) 125° (g) 150°

2. Draw the angles below using the set squares and ruler:

(a) 45° (b) 30° (c) 60° (d) 90° (e) 120° (f) 135° (g) 150°

3. Draw the following angles using the compass and ruler.

(a) 60° (b) 120° (c) 90° (d) 45° (e) 30°

Project work

By using the ruler and pencil, draw the approximate angles of 30°, 45°, 60°,90° and 120° different from each other. Draw the exact angles of 30°, 45°, 60°,90° and 120° on the same vertices and base lines by using the compass. How much difference did you get in the values of these angles drawn before by using the ruler and pencil without compass and drawn by using the compass? Measure them by using the protractor and prepare a document

Answers

Show all the answers to your teacher.

Lesson 15

Plane Shapes

15.0 Review

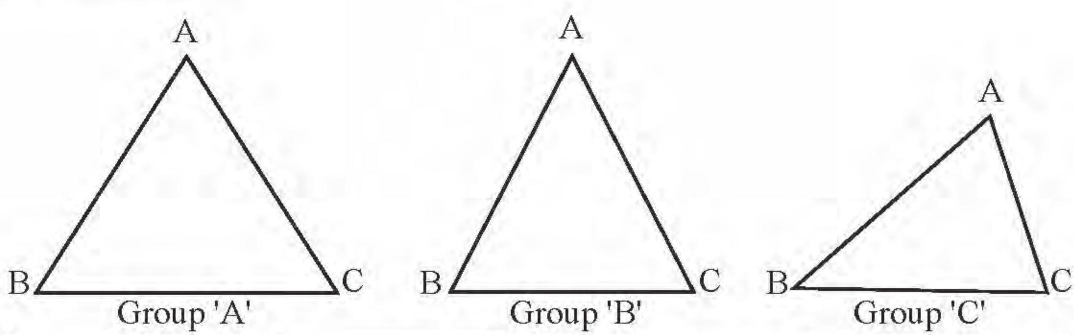
Make the students collect three small bamboo pieces or sticks. Make them form a closed figure by using these collected materials. Discuss in the groups whether the triangles are formed or not. If formed, what type of triangles are formed? Find the conclusion and present it in the classroom.

15.1 Classification of triangles

Activity 1

Classification of triangles on the basis of sides

Sit in the groups of three students each. Take the measures of all sides of different triangles ABC given by the teacher one in each group and fill up the table given below. Discuss the following questions and present the conclusions in the classroom.



AB	BC	AC	Results

Each group compare the lengths of the sides of your triangle as below:

(i) Are the lengths of all sides equal?

(ii) Are the lengths of any two sides equal?

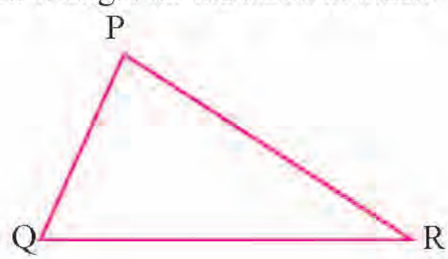
(iii) Are the lengths of all sides different?

Now, each group presents the conclusion of the measurements and type of your triangle in the classroom.

If all the sides of a triangle are equal then it is called an ***Equilateral triangle***. If any two sides of a triangle are equal then it is called an ***Isosceles triangle***. Similarly, if the lengths of all the sides of a triangle are different then it is called a ***Scalene triangle***.

Example 1

Classify the given triangle on the basis of sides.



Solution:

Measuring all the sides of the given triangle PQR,

we have,

PQ = 2.7 cm,

QR = 5 cm and

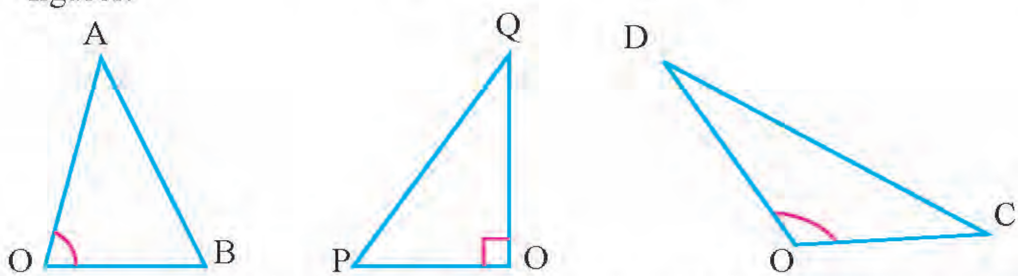
PR = 4.6 cm.

As the lengths of all sides of the triangle are different, so PQR is the *Scalene triangle*.

Activity 2

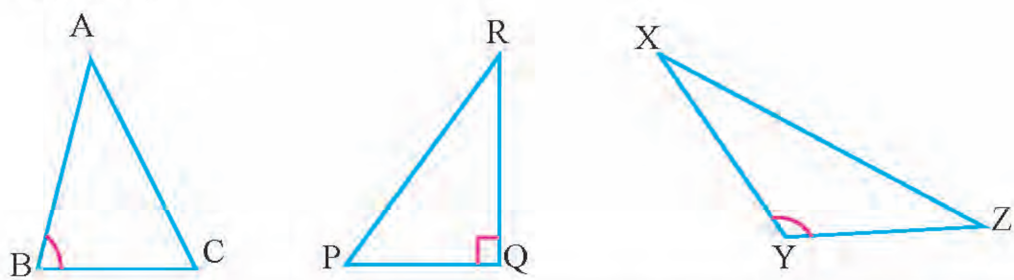
Classification of triangles on the basis of angles

(a) Sit in the groups of three students. Each group draw an acute angle, a right angle and an obtuse angle using the ruler and pencil as shown in the figures.



Join the other ends of the arms of the angle made by you. What type of angles will the triangles so formed have?

(b) Exchange the members of a group with each other. Measure the angle using the protractor. Fill up the following table by these measurements. With the help of a teacher, decide what type of triangles are formed on the basis of the angles. Present your group work with conclusion in the classroom.

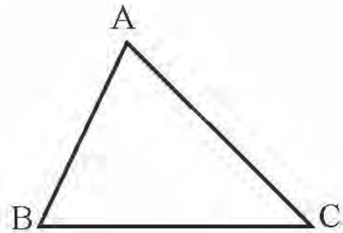


ΔABC	ΔPQR	ΔXYZ	Results
∠ABC =	∠PQR =	∠XYZ =	
∠ACB =	∠PRQ =	∠YZX =	
∠CAB =	∠QPR =	∠YXZ =	

If one angle of any triangle is 90 ° then it is called a *Right angled triangle*. If all angles of a triangles are acute angle then it is called an *Acute angled triangle*. If one angle of a triangle is obtuse angle then it is called an *Obtuse angled triangle*. In the above figure, ΔABC, ΔPQR and ΔXYZ are acute angled, right angled and obtuse angled respectively.

Example 2

Classify the given triangle on the basis of angles:



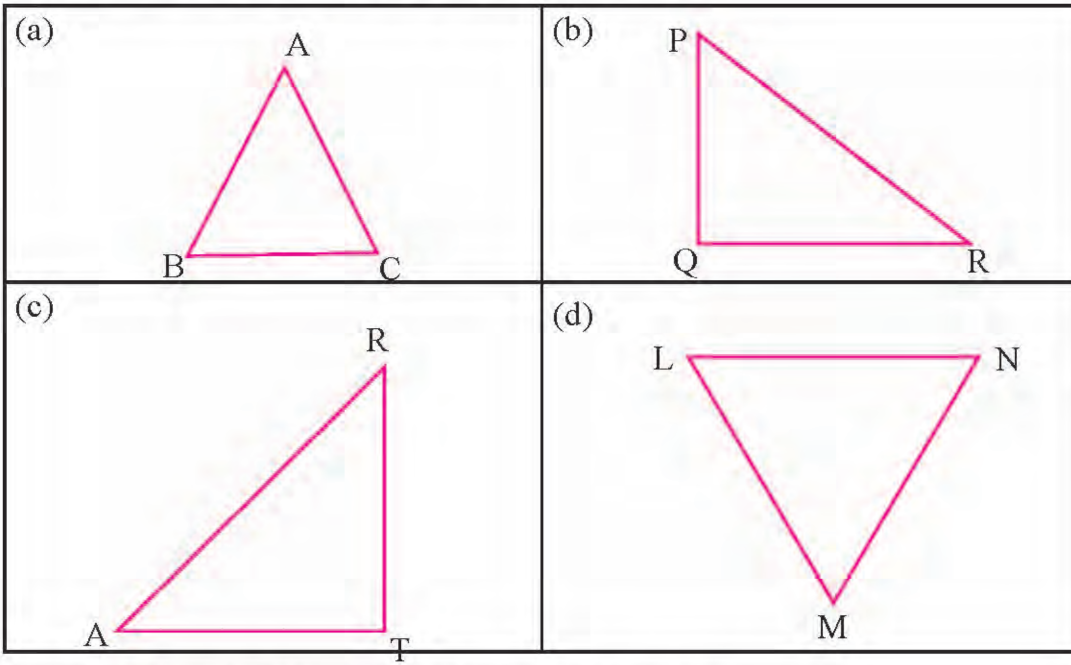
Solution:

Measure the angles of the given triangle by using the protractor, we have $\angle ABC = 75°$, $\angle BCA = 45°$ and $\angle BAC = 60°$. Here, all angles of the triangle ABC are acute angle. So, the triangle ABC is acute angled triangle.

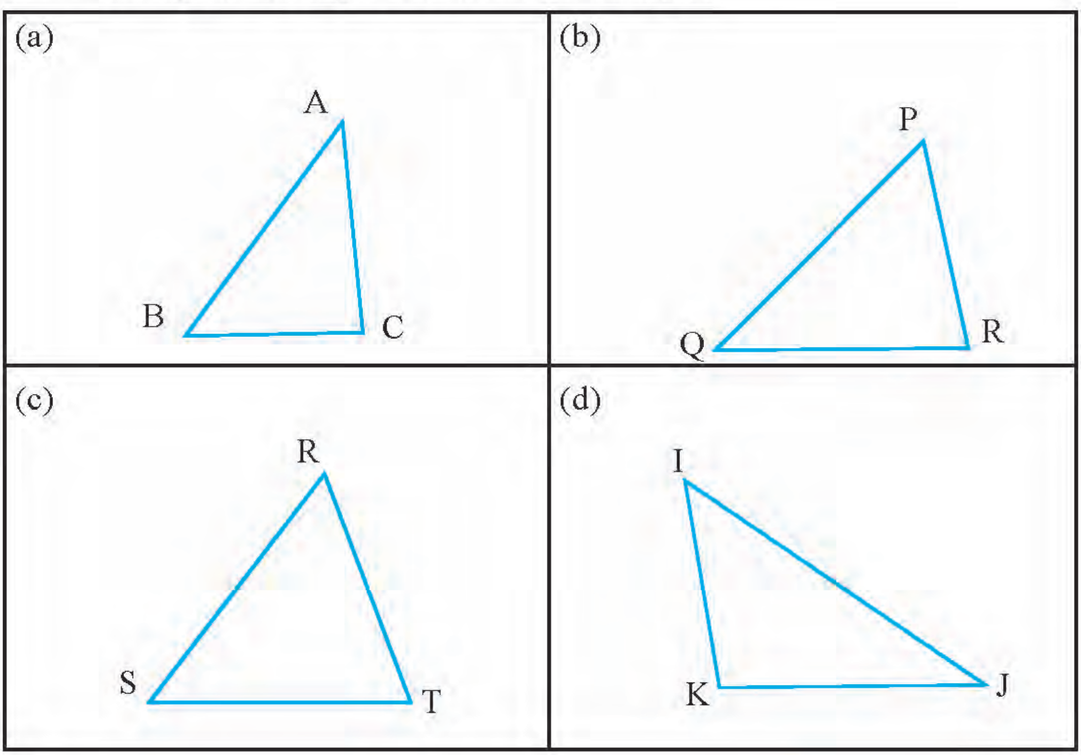
Exercise 15.1

1. **Fill up the following blank spaces with proper word:**
   (a) In an equilateral triangle, all angles are………
   (b) A triangle whose all sides are unequal is called………..
   (c) On the basis of the sides, there are ……… types of triangles.
   (d) A triangle whose any one angle is greater than 90° is called ……….. triangle.
   (e) If any triangle is equilateral on the basis of sides then it is always ……….. triangle on the basis of angles.

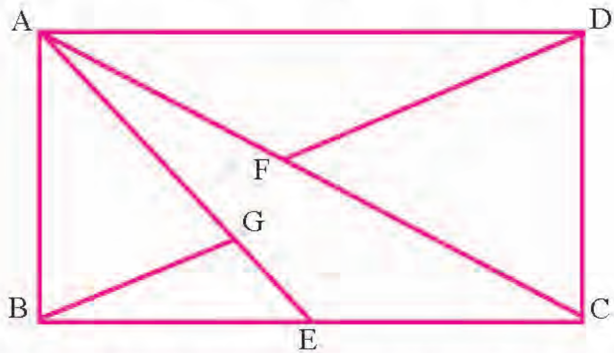
2. Classify the triangles on the basis of sides:



3. Classify the triangles on the basis of angles:



4. **Observe the given figure and write down the names of two acute angled, right angled and obtuse angled triangles.**



5. (a) Draw a triangle POQ with $\angle POQ = 120°$. Find the measures of the remaining angles using the protractor.

   (b) Draw a triangle XYZ with $\angle XYZ = 60°$. Take the measures of its remaining angles using the protractor.

   (c) Draw a triangle LMN with $\angle LNM = 90°$. Take the measures of its remaining angles using the protractor.

6. Discuss the solutions and types of the triangles of all the questions of the question number 5 above. Find out the conclusions and present in the classroom.

Project Work

Prepare the models showing the classifications of the triangles on the basis of the sides and angles by using the small bamboo pieces or the sticks and present them in the classroom

Answers :

Show all the answers to your teacher.

15.2 Quadrilaterals

Observe the frames and panes of the windows and gates of a classroom, surfaces of the book, benches and teaching board. Find, how many edges and angles are there in each objects.

Rectangle

Activity 1

Take a piece of paper. Continue folding it as shown in the figure. What is the name of the figure formed in the middle? Discuss with friends.

(i) (ii) (iii)

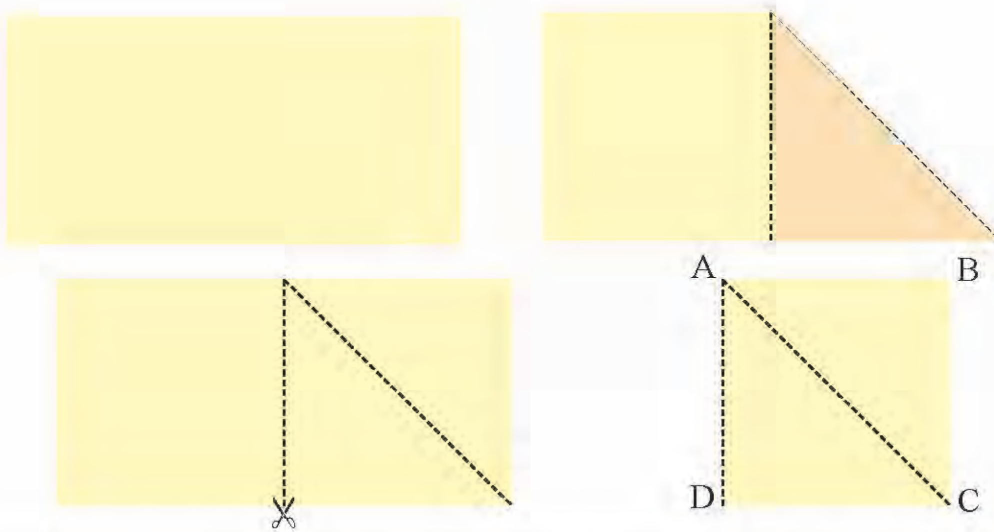
(iv) (v) (vi)

A quadrilateral whose opposite sides are equal and each are 90° is called a *Rectangle*. In the above figure, ABCD is a rectangle.

Square

Activity 2

Take a rectangular piece of paper. Continue folding it as shown in the figure. What is the name of the figure formed at last? Discuss with your friends.



A quadrilateral whose all sides are equal and all angles are 90° is called a *Square*. In the above figure, ABCD is a square.

Parallelogram

Activity 3

Make groups of two students each. Each group draw a straight line segment AB of equal length. Draw another line segment CD parallel and equal to AB by using the ruler. Now join the corresponding ends of these line segments on the same sides. What type of quadrilateral is formed? Discuss among the groups and present the common conclusion in the classroom.

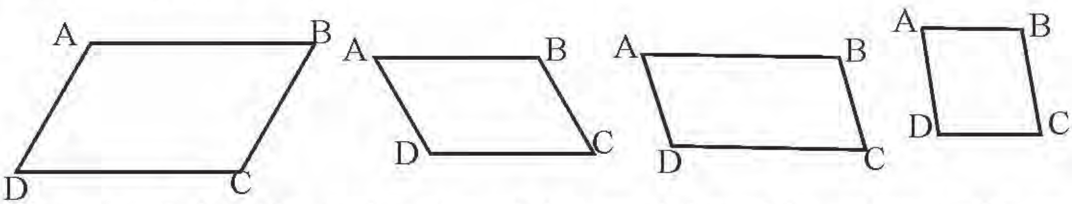
Activity 4

Take a rectangular piece of paper. Mark on both sides of that paper at equal distances as shown in the figure. Fold it as shown in the figure. What is the name of the figure formed? Discuss with your friends.

A quadrilateral whose opposite sides are parallel is called a ***Parallelogram***. In the above figure ABCD is a parallelogram.

Activity 5

Make groups of two students each. Each group draw a quadrilateral of the following types.



Measure all the sides and angles of that quadrilateral by using a ruler and protractor. What are the relations of the sides and the measures of the angles? Discuss in the groups and present the conclusion in the class room. For example: In the above first figure, AB = 3 cm, CD = 3 cm, AD = 2cm, BC = 2 cm, $\angle ABC = \angle ADC = 60°$ and $\angle BCD = \angle DAB = 120°$.

The opposite sides and angles of a parallelogram are equal

If all the sides of a quadrilateral are equal and non of the angles is 90° then it is called a ***Rhombus***.

Activity 6

In the above activity 5, what type of figure will be formed if all the sides are equal? Discuss in the groups and write the conclusion.

If all the sides of a quadrilateral are equal then it is called a ***Rhombus***.

Similarly, in the same activities 5 above, what type of quadrilateral will be formed if the value of each angle is 90°? Discuss in the groups.

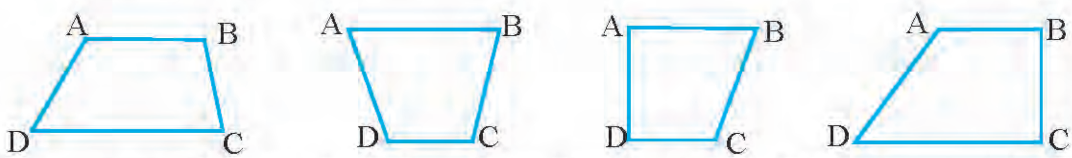
Trapezium

Activity 7

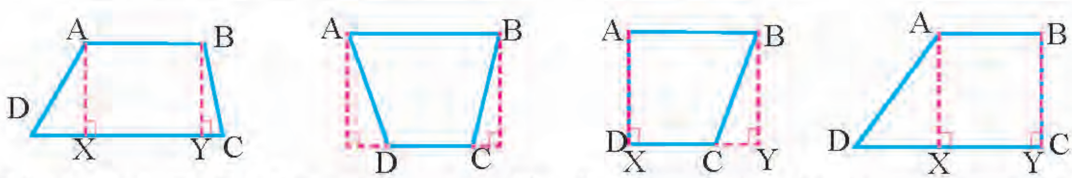
Sit in the groups of two students each. Each group draw a straight line segment. Draw another line segment parallel to that line segment by using a set square. Now join the remaining ends of these parallel line segments towards the same sides. Discuss in groups about what type of quadrilateral is formed and present the common conclusion in the classroom.

Activity 8

Sit in the groups of two students each and draw a quadrilateral ABCD in each group as shown in the given figures.



In each quadrilateral, draw the perpendiculars AX and BY from A and B to CD. Measure the lengths of AX and BY using a ruler. What type of lines are AB and CD on the basis of the lengths of AX and BY?

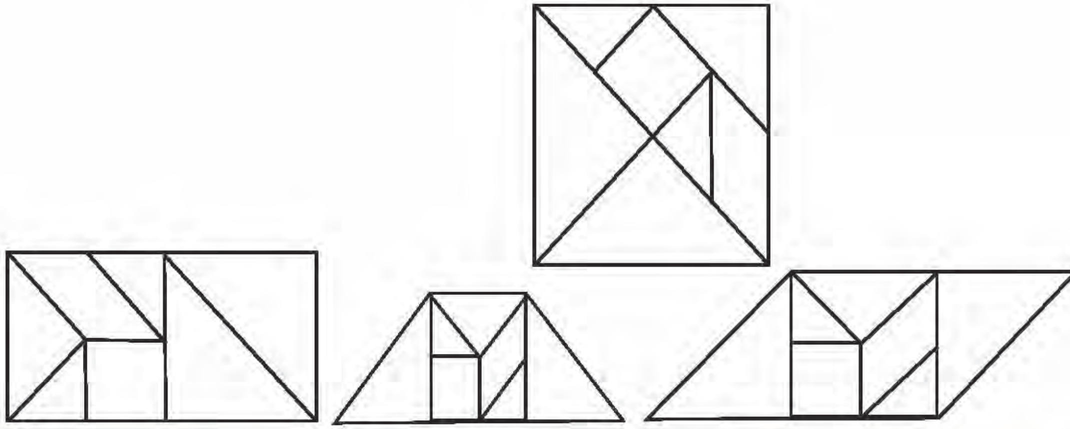


The perpendicular distances are equal in all the cases. So the line segments AB and CD are parallel. Such quadrilateral is called a ***Trapezium***.

> If one pair of opposite sides of a quadrilateral are parallel then it is called a ***Trapezium***.

Construction of the quadrilaterals by using a tangram

Sit in the groups of five students each and take a tangram in each group. Using that tangram, make each one of the rectangle, square, parallelogram, trapezium and rhombus and trace them in your copy. Present the group work in the classroom.



Example 1

Find what type of quadrilateral is the given quadrilateral.

Solution:

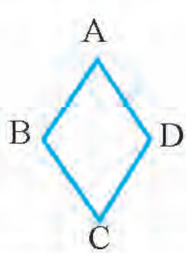
Here, in the quadrilateral CDEF, lines CF = DE = 4 cm. Similarly, DC = EF = 2.5 cm and ∠CDE = ∠DEF = ∠CDE = ∠EFC = ∠FCD = 90°.

As the opposite sides are equal and all angles are 90°, so CDEF is a rectangle.

Exercise 15.2

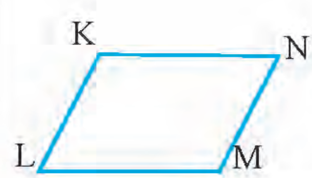
1. **Identify whether the following statements are true or false:**
   (a) All sides of a square are equal.
   (b) Square and rhombus are the same.
2. **Classify the following quadrilaterals by measuring their sides and angles:**

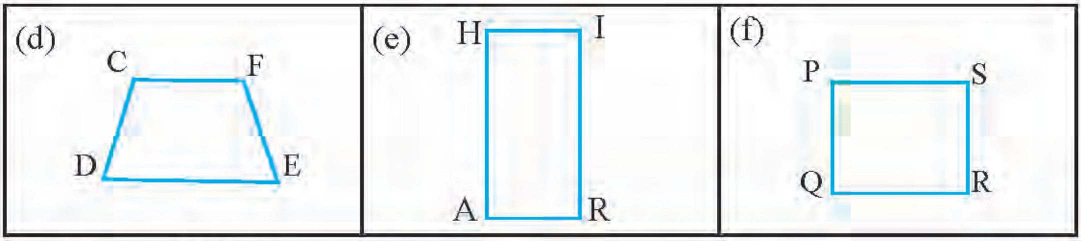
(a)



(b)

(c)





Project Work

Observe your classroom, house, school and the other public sites. In those places, write the names of the two objects each having the shapes of the parallelogram, rectangle, square, trapezium and rhombus. Draw their figures and present in the classroom.

Answers:

Show all the answers to your teacher.

Mixed exercise:

1. **Enjila said, "A quadrilateral having all sides equal is a rectangle." Enjal disagreed with it and he said, "A quadrilateral having opposite sides equal and all angles 90° is a rectangle." Which of the following figures supports Enjal's saying?**

2. **Study the figure and answer the following questions.**

   (a) Write the names of four pairs of the intersecting lines.

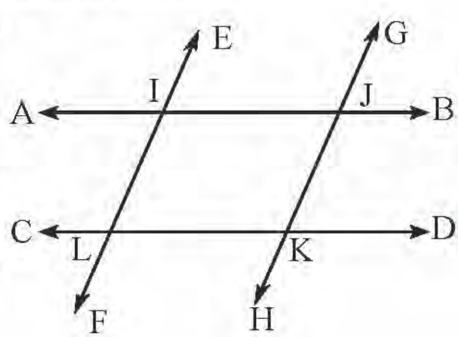
   (b) Write the names of two pairs of the parallel lines.

   (c) Find the measures of the angles $\angle LIJ$, $\angle IJK$, $\angle ILK$ and $\angle LKJ$.

   (d) What type of quadrilateral is IJKL?

   (e) What type of quadrilateral will it be if $\angle ILK$ and $\angle LKJ$ are 90° ?

   (f) In which condition will the quadrilateral IJKL be a square?



Lesson 16

Circle

16.0 Review

Do the following activities. What type of figure is formed? Discuss with your friends.

(a) Mark around a coin by a pencil.

(b) Mark around a bangle by a pencil.

(c) Mark around a bottle cap by a pencil

16.1 Introduction to circle

Activity 1

Take a compass from in your geometry box with a sharp pencil. Fix the needle of a compass at any point of a copy and rotate the tip of the pencil. What type of figure is formed now? Discuss with friends and answer the following questions:

(a) What is the name of the point at which the needle of the compass is fixed?

(b) What is the name of the distance between the pointer of the compass and the tip of the pencil?

(c) How is the path made by the tip of the pencil?

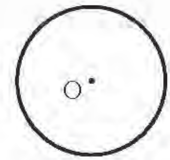
(d) What is the name of the path made by the tip of the compass?

The path of a point which moves in such a way that its distance from some fixed point is always constant is called a ***Circle***.

16.2 Different parts of a circle

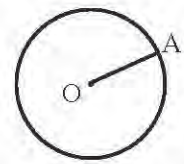
1. **Centre**

A point lying inside a circle which is equidistant from the circumference of the circle is called its centre. In the given figure, O is the centre of the circle.



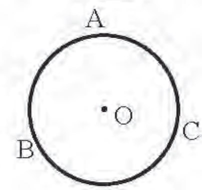
2. **Radius**

The line segment joining the centre and circumference of a circle is called its radius. In the given figure, OA is the radius of the circle.



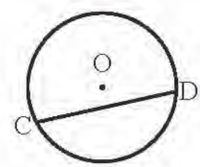
3. **Circumference**

The closed boundary or path of a circle around its centre is called its circumference. In the given figure, ABC is the circumference of the circle.



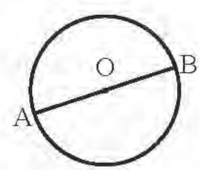
4. **Chord**

A line segment joining any two points of a circumference of a circle is called its chord. In the given figure, CD is the chord of the circle.



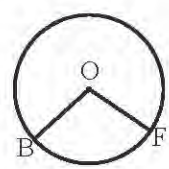
5. **Diameter**

A chord of a circle passing through its centre is called its diameter. In the figure, AB is the diameter of the circle.



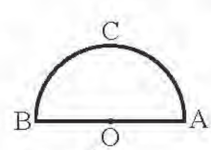
6. **Sector**

The area between any two radii of a circle is called its sector. In the given figure, BOF is the sector of the circle.



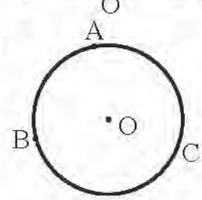
7. **Semi-circle**

The half of the whole area of a circle is called its semi-circle. In the given figure, ABC is a semi-circle.



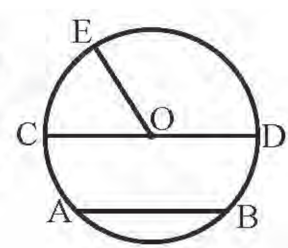
8. **Arc**

A portion or part of the circumference of a circle is called its arc. In the given figure, (AB)ˆ is the arc of the circle ABC.



Exercise 16.1

1. **Identify whether the following sentences are true or false:**
   (a) A circle has two centres.
   (b) Diameter of a circle passes through its centre.
   (c) A line segment joining any two points of the circumference of a circle is called its radius.
   (d) The area between any two radii of a circle is called a sector.
   (e) All chords of a circle are not its diameters.
   (f) A circle has only one diameter.
   (g) A diameter of a circle is twice its radius.
2. What is the centre of a circle? Make a figure to illustrate it.
3. What is the circumference of a circle? Illustrate it with figure.
4. What is the difference between the diameter and radius of a circle? Show it by the figure.
5. Define a sector of a circle.
6. What is the difference between the diameter and chord of a circle? Illustrate it with figure.
7. How many semi-circles are there in a circle? Show them in the figure.
8. Write the names of different parts of the adjoining circle.



Project work

How do you find the centre and diameter of your eating plate or dish having circular bases? Discuss with a teacher and present in the classroom.

Answers:

Show all the answers to your teacher.

Lesson 17

Solid Objects

17.0 Review

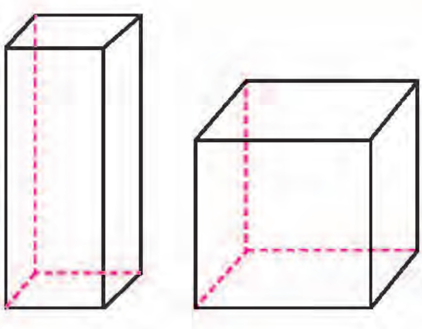
List the names of geometrical solid objects having the plane surfaces. Then, discuss with your friend and prepare a common list. Take turns to present each pair's list. Make a table like the following on the board and complete the table.

Plane Surfaces	Solid objects
Rectangle	Cuboid
Square	
Circle	

Discuss about the above table with your friends. Why are they different? Conclude and present.

17.1 Faces, edges and vertices of a cuboid and cube

Activity 1



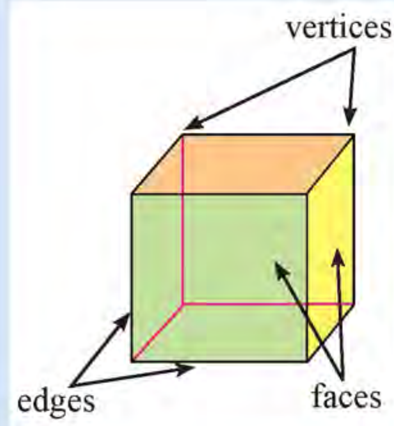
Sit in the proper form groups. Each group should choose one of the solid objects as shown in the figure. Observe the objects, discuss, find out the following parts and present in the classroom.

(a) Closed plane figure formed by the four straight edges.

(b) Parts formed by joining two faces.

(c) Points of intersection of the three straight edges.

The plane or flat surface of any solid object is called its face. It is denoted by F in English. A straight line joining any two faces of solid object is called its edge. It is denoted by the English alphabet E. The point at which two or more than two edges are joined is called a vertex of the solid object. It is denoted by the English alphabet V.



17.1.1 Relationship beween face, edge and vertex

Activity 2

Divide the students into appropriate number of groups. Each group take a solid object. Observe and discuss those objects, find the following things and present them in the classroom:

(a) How many plane surfaces are there in the given solid object. Count.

(b) How many straight edges are there in the given solid object? Count.

(c) How many vertices are there in the given solid object? Count.

(d) Each group, add the numbers of vertices and the faces that you have counted.

(e) Subtract the number of edges from that sum.

(f) Find out the relationship between the faces, vertices and edges of the cuboid and cube.

If V be the vertices, E be the edges and F be the faces of a cube or a cuboid, then we alwats have V - E + F = ?

Example 1

If a chalk box has 6 faces and 8 vertices, find out the number of edges.

Solution:

Here, the number of faces of the chalk box (F) = 6

Number of vertices (V) = 8

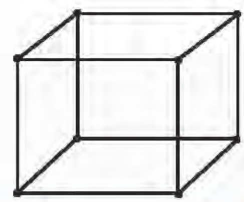
Number of edges (E) = ?

We know that $V - E + F = 2$

Or, $8 - E + 6 = 2$

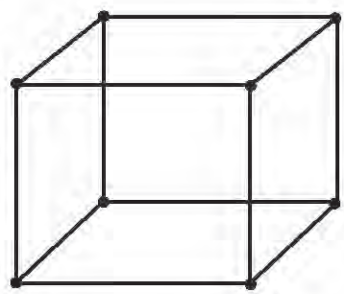
Or, $14 - E = 2$

Or, $E = 14 - 2 = 12$



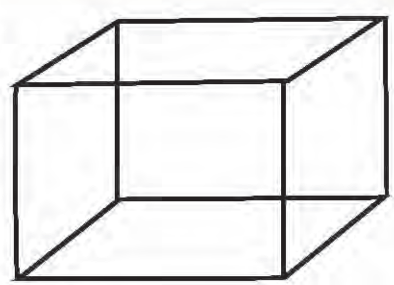
17.1.2 Skeleton model of cube

Be in appropriate number of groups. Each group, take 12 straight bamboo picks having equal lengths and 8 pieces of potato or any other soft objects. Now join the straight bamboo pieces and the potato pieces as shown in the figure. What type of shape is formed? How many faces, edges and vertices are formed in this model? Observe and discuss in your group.



17.1.3 Skeleton model of a cuboid

Be in appropriate number of groups. Each group, take 12 juice pipes or wheat stalks (8 of them equal in one fixed length and 4 of them equal in other fixed length) and some thread. Then form two squares by using 8 pieces. Join the vertices of the two squares with the remaining 4 juice pipes and the thread. What type of shape is formed? How many faces, edges and the vertices are there the shape? Observe and discuss in the groups.



Exercise 17.1

1. **Identify, whether the following statements are true or false:**
   (a) All edges of a cube are equal.
   (b) A cube has five square faces in total.
   (c) Total number of vertices of a cube is less than that of a cuboid.
   (d) If all the edges of a cuboid are equal, it is called a cube.
   (e) All faces of a cuboid are not equal.
2. **Write the answers of the following questions:**
   (a) What is a cube?
   (b) What do you mean by the faces, edges and the vertices of a cuboid?
   (c) Write the formula that represents the relationship between the faces, edges and the vertices of a cuboid.
   (d) Write the main difference between a cube and a cuboid.
3. **A cubical dice has 12 edge. How many edges should there be need so that it has 6 faces? Find it.**
4. **A tank in form of a cuboid has 6 faces in total. How many edges should there be need so that it has 8 vertices? Find it.**
5. **Prepare the models of cube and cuboid of different measurements by using the empty refills, wheat stalks, bamboo or bambusa picks and threads and present them in the classroom.**

Answers:

Show all the answers to your teacher.

17.2 Cylinder, sphere and cone

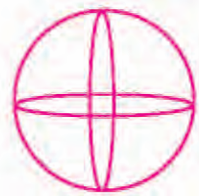
All groups take a solid object like show in below. Observe the object and discuss to find out the answers to the following questions:

(a) How many and what type of faces are there in the given sold figure? Count and write them.

(b) How many straight edges are there in the given solid figure? Count them.

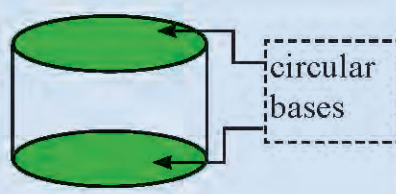
(c) How many vertices are there in the given sold figure? Count them.

(d) Can those objects be rolled on?



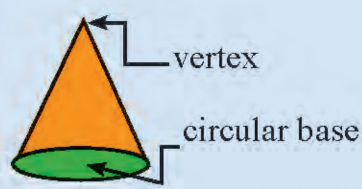
From the above discussion, the following conclusions can be found:
In the first figure, there are two circular faces. It has no vertex but one curved surface. It is a cylinder.
Similarly, in the second solid figure, there is one vertex, one circular face and one curved surface. It is a cone.
Observing the third object we see that there is no vertex and plane surface. It has only curved surface. It is called a sphere.

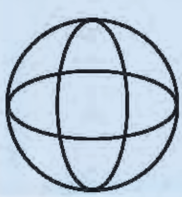
A solid figure having two equal and parallel circular faces and one curved surface is called a cylinder. For example,



A solid figure having one vertex, one circular base and one curved surface is called a cone.

For example,





A solid figure having no plane surface and no vertex but only curved surface is called a sphere. For example,

Example 1

What type of shapes do the following solids have? Write with reason.

(a) 	(b) 	(c) 

Solution:

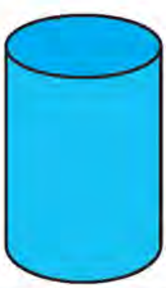
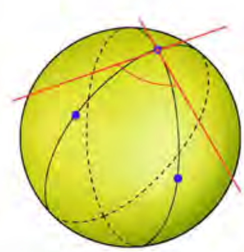
(a) Here, the given solid is a cylinder because it has two circular faces and one curved surface.

(b) Here, the given solid is a sphere because it has no vertex and no plane surface but only one curved surface.

(c) Here, the given solid is a cone because it has one vertex, one circular plane surface and one curved surface.

Exercise 17.2

1. What type of shapes do the following solid objects have? Write with reason.

(a) 	(b) 	(c) 
(d) 	(e) 	(f) 

2. **Answer the following questions:**

   (a) What is a cylinder? Write any two properties of it.

   (b) Write one similarity and one difference between the cylinder and the cone.

   (c) What is the difference between the sphere and the cylinder? Write.

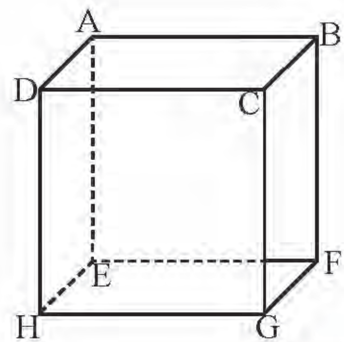
3. **What is the difference between the plane figure and the solid object? Explain with figures.**

4. **Study the adjoining cuboidal shape.**

   (a) Write the names of all the six plane surfaces.

   (b) Identify three pairs of parallel faces.

   (c) In which condition will the given shape become a cubical shape?



Project work

Find out each of five spherical, cylindrical and conical objects that are at your home or used at your home and present them in the classroom

Answers:

Show all the answers to your teacher.

Lesson 18

Co-ordinate Geometry

18.0 Review

Take a deck of number card having 1 to 9 and letter card having A to I from. Play the following game in groups of 4 students:

(a) Each group draw a letter card first and then a number card from the both decks of cards.

If the first card is C below on it and the second card has 6 on it, write C,6 in the grid board corresponding to C,6 and colour as shown in the following grid board.

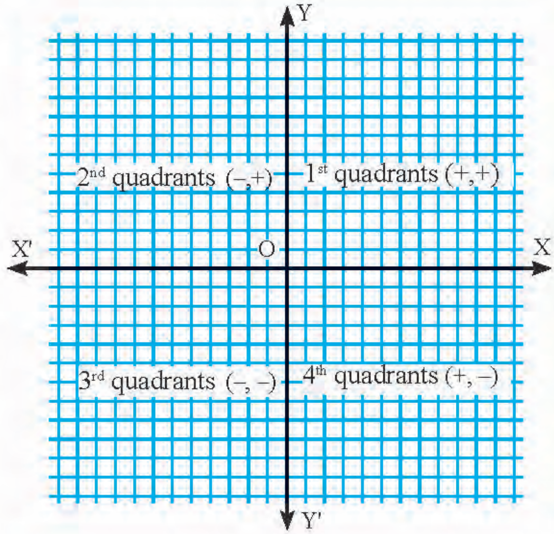
(b) Put the letter card and the number card back to the respective decks.

(c) In the same way, draw the letter and number cards five times and write them in the respective grid boxes and fill up the boxes with different colours.

(d) At last, count up and write how many units those coloured boxes are located horizontally and vertically on the grid board. For example: Draw the conclusion as (C,6) = (3,6). Whichever group has the highest number of correct answers will be the winner.

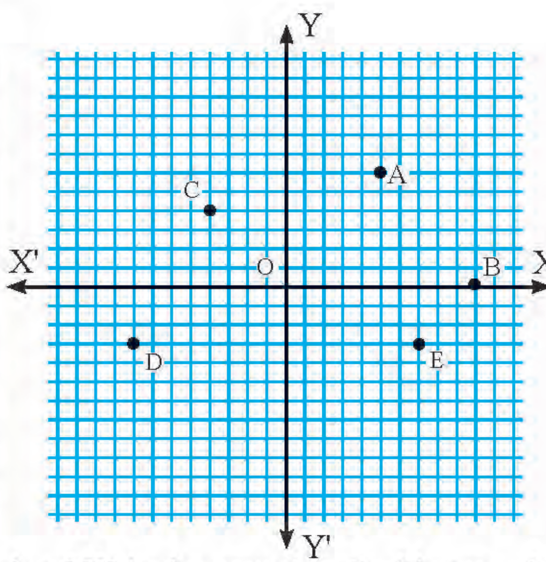
9									
8									
7									
6			C,6						
5									
4									
3									
2									
1									
0	A	B	C	D	E	F	G	H	I

18.1 Axes and quadrant



The adjoining figure alongside is a graph board. Study it. In this board the straight lines XX' and YY' are bisected perpendicularly at the point O. The point O is called the origin. The straight lines XX' and YY' bisected at the point O are called the axes. Here, XX' is called the X-axis and YY' is called Y-axis. OX is called the positive X-axis and OX' is called the negative X-axis. Similarly, OY is called the positive Y-axis and OY' is called the negative Y –axis. In this graph board, XOY, YOX', X'OY' and Y'OX are called the quadrants. They are called the 1st, 2nd, 3rd and 4th quadrants respectively.

18.1.1 Coordinates



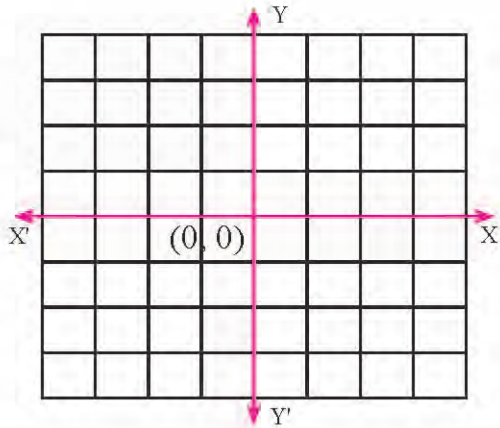
Observing the given graph paper, how many units should we move to the right and to the up reach the point A from the point O? Calculate it. Here, we can reach the point A by moving 5 units right and 6 units up from the point O. It is written as (5,6). Here, (5,6) are called the coordinates of the point A. Similarly, to reach to the point D, we need to move 8 units left and 3 units down from the point O. It is written as (-8,-3) which are the coordinates of the point D. What will be the coordinates of the other points? Write by counting. In this way, the X-coordinate of any point is positive if it is on the right side of the origin O and negative if it is on the left side of the origin O.

Likewise, the Y-coordinate of a point is positive if it is above the origin O and negative if it is below the origin O. This can be shown as in the following table:

Right, up → (+,+)
Right, down→(+,-)
Left, up → (-,+)
Left, down→ (-,-)

Activity 1

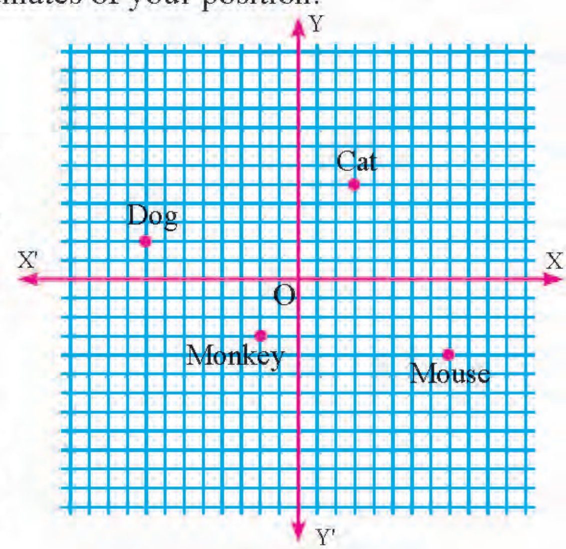
Make a grid on the ground by using a colour or a rope as shown in the figure. Do the following activities starting from (0,0):



Take two dices one red and another blue. Take two coins also. Mark right and left on the first coin and up and down on the second coin. Now toss the first coin and red dice and the second coin and blue dice together. Write the number appearing on the red dice on the grid box horizontally and right or left. Similarly write the number appearing on the blue dice on the grid vertically and up or down. When all of your finish doing that, identify your place and stand over there. Finally, write coordinates of your position.

Example 1

Write, how many units should we move from the origing right, left, up or down to reach the positions of the animals shown in the adjoining figure.



Solution:

Here, from the graph paper, 3 units right and 5 units up should be moved from the origin to reach the position of the cat.

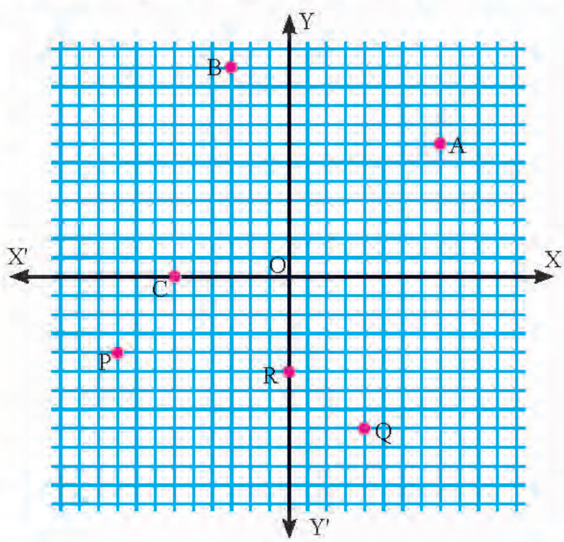
So the position of cat is (3,5). To reach the position of the dog, 8 units left and 2 units up should be moved from the origin. So, the position of the dog is (-8,2). To reach the position of the monkey, 2 units left and 3 units down should be moved from the origin. So the position of the monkey is (-2,-3). To reach the position of the mouse, 8 units right and 4 units down should be moved from the origin. So the position of the mouse is (8,-4).

Example 2

Find the coordinates of the points given in the adjoining graph.

Solution:

Here, the coordinates of the points given in the graph can be found as below:



To reach the point A, 8 units right and 7 units up should be moved from the origin. So A lies in the first quadrant. Its coordinates are (8,7). To reach the point B, 3 units left and 11 units up should be moved from the origin. So, it lies in the second quadrant. Its coordinates are (-3,11). To reach C, 6 units left should be moved from the origin. Here, no up or down movement is needed. So, it lies on the negative X-axis. Its coordinates are (-6,0). To reach P, 9 units left and 4 units down should be moved from the origin. So, it lies in the third quadrant. Its coordinates are (-9,-4). To reach Q, 4 units right and 8 units down should be moved from the origin. So, it lies in the fourth quadrant. Its coordinates are (4,8). To reach R, 5 units down should be moved from the origin. So, it lies on the negative Y-axis. Its coordinates are (0,-5).

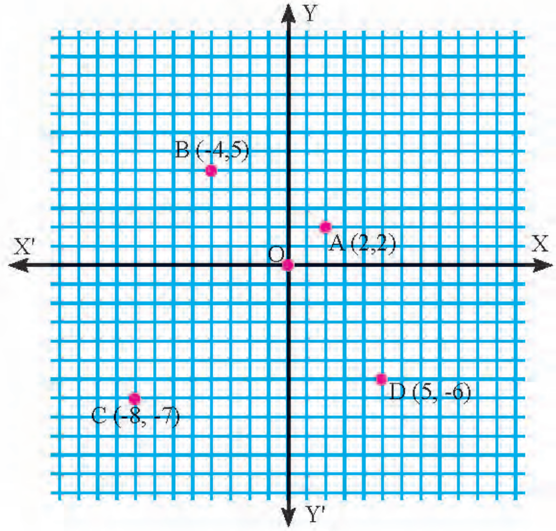
Example 3

Plot the given points on the graph.

A(2, 2), B(-4, 5), C(-8, -7), D(5, -6),

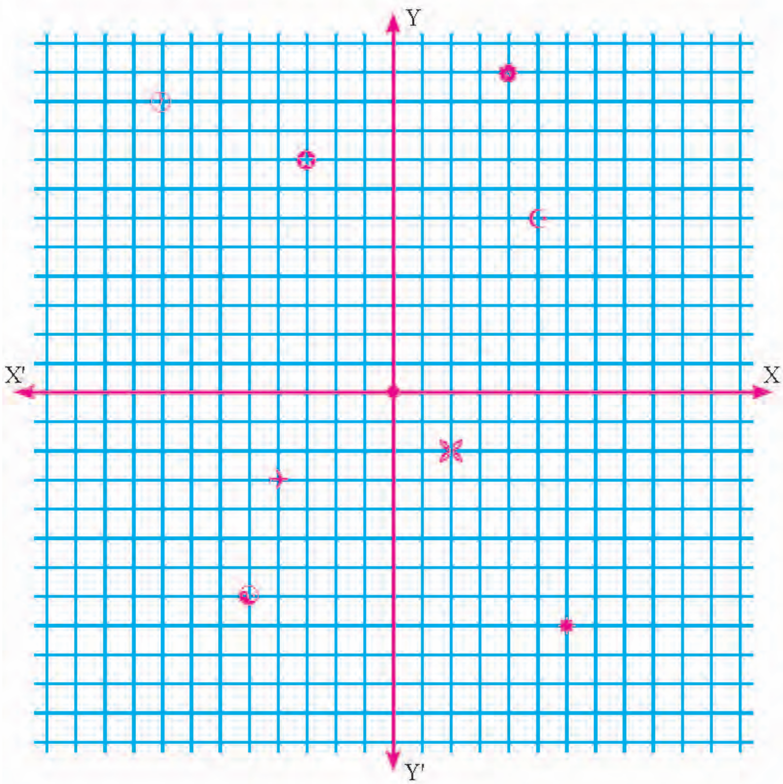
Solution:

The above points are plotted as shown in the graph paper.

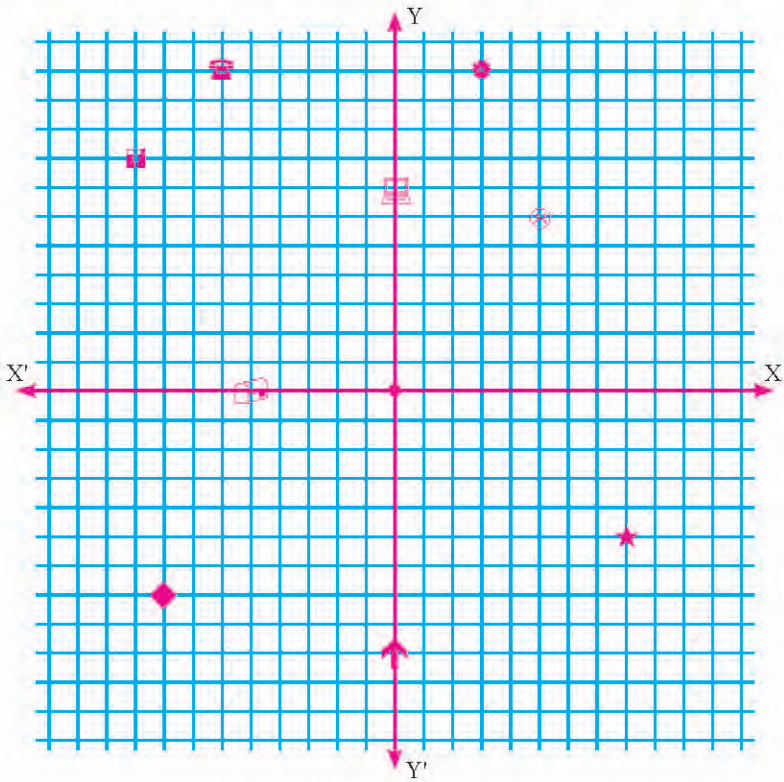


Exercise 18

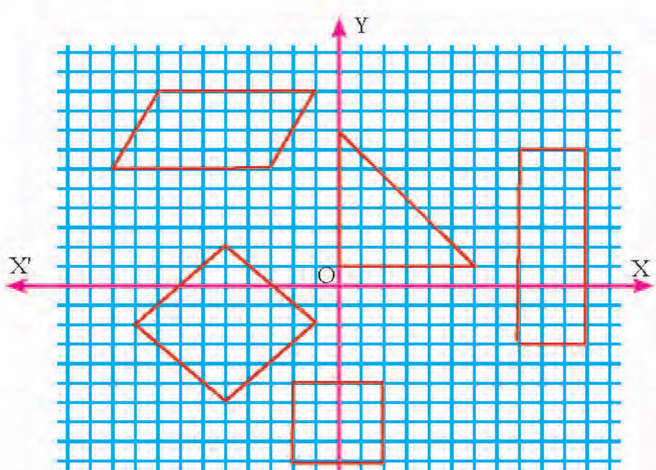
1. **In which quadrants or axes do the objects given in the following graph paper lie. Find.**



2. **Find the coordinates of the shapes marked in the given graph paper.**



3. **Find the coordinates of the vertices of the figures marked in the following graph.**



4 **(i)** **Plot the following points on the graph paper. Join these points in order? What shapes are formed? Write their names.**

(a) (4,4), (-4,4), (-4,-4), and (4,-4)

(b) (0,6), (-6,0) and (6,0)

(c) (6,0), (6,7) and (0,-2)

(d) (8,9), (4,9), (6,2) and (2,2)

(c) (0,9), (5,9), (0,-2) and (5,-2)

(ii) Find the area of the figures formed in the above graph by counting their unit squares.

(iii) Which figure has the largest area?

Project work

Imagine that one of the corners of the classroom is the origin. Draw the lines so that you make square boxes. Take the edges representing the length and the breadth of the room passing through the origin as X and Y areas. Identify your own and your friends' positions in terms of the coordinates.

Answers:

Show all the answers to your teacher.

Lesson 19

Symmetry and Tessellation

19.0 Review

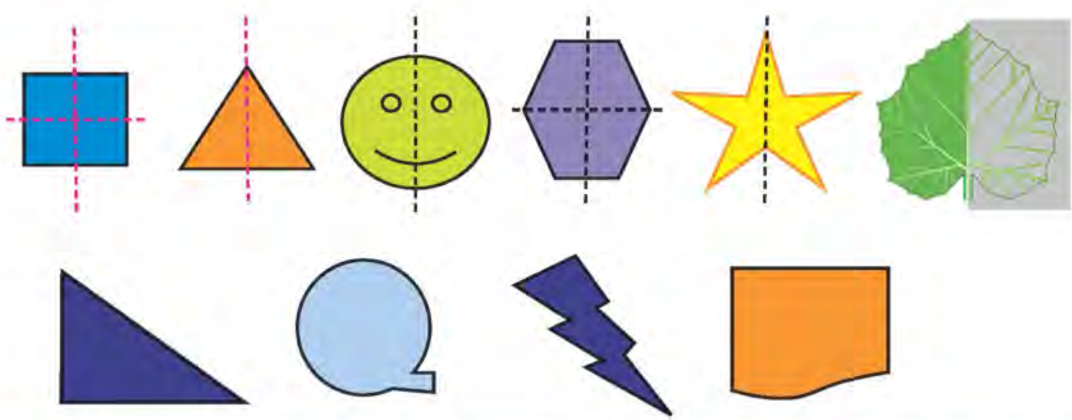
All of you, draw a figure of your choice. Can the figure you made be divided into two equal parts or not? If yes, in how many ways can they be divided?

Discuss in groups with your friends and present in the classroom.

19.1 Symmetric figures

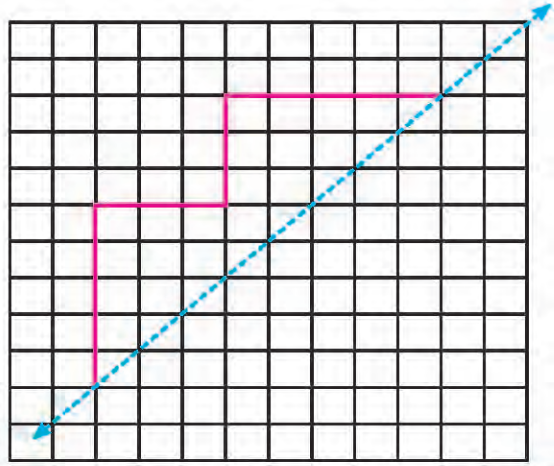
Activity 1

All of you, take any figure one of your choice and fold it into two equal parts. Could you all fold each figure into two equal parts? Which figure sould you fold into two equal parts and in how many ways? Discuss with the friends of your bench. Draw a dotted line on the folded parts. Observe the parts of the figure on both sides from the dotted line. Are they exactly equal and similar? Discuss with the friends.



The figures or shapes that can be folded into two equal parts are called symmetric figures. The dotted line drawn on the folded part is called axis of symmetry.

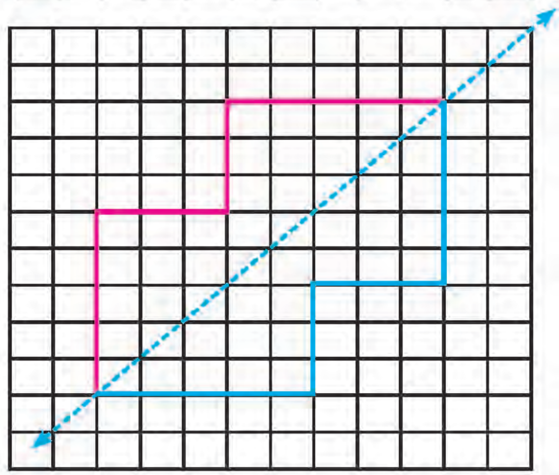
Example 1



Taking the dotted line as the line of symmetry, complete the given shape in the given figure.

Solution:

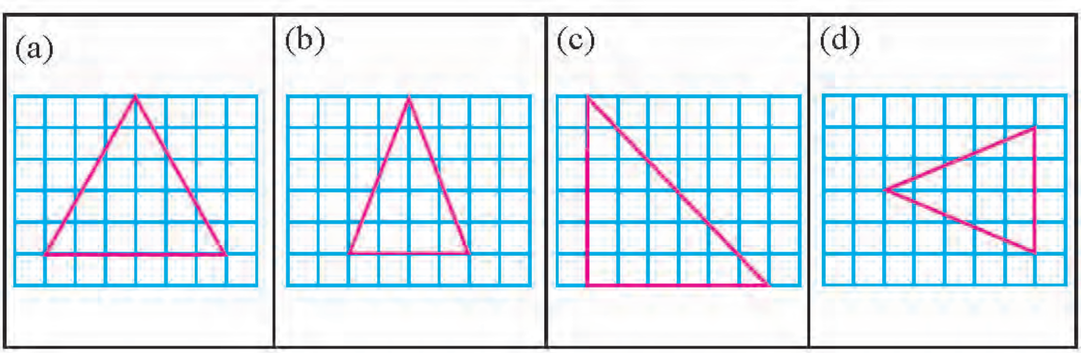
Here, taking the dotted line as the axis of symmetry, we have to draw the same figure on the other side of the axis of symmetry. The given figure and its image on the other side are equidistant from the line of symmetry.



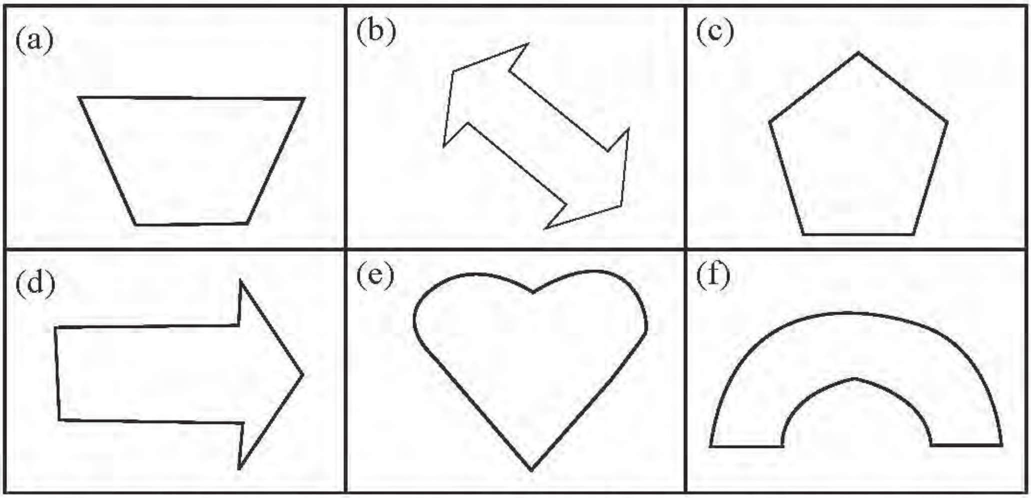
The symmetric figure is shown on the right side of the axis of symmetry.

Exercise 19.1

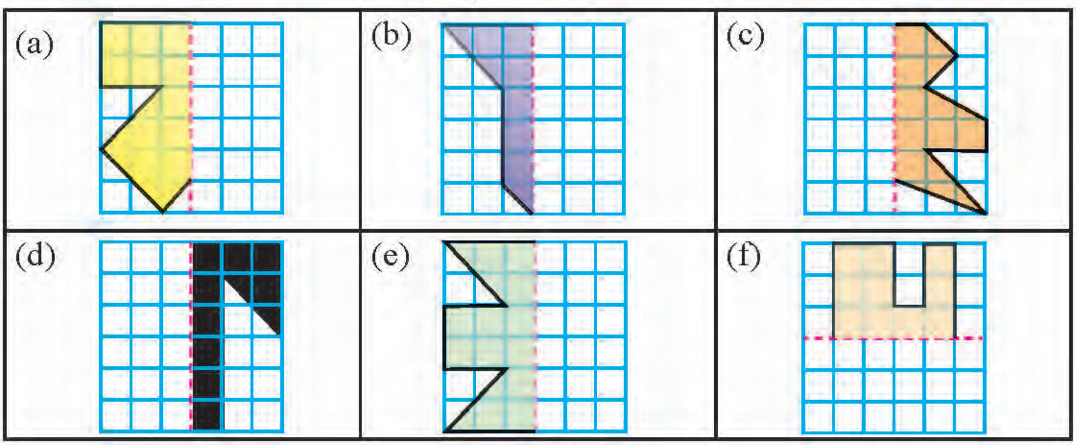
1. **Draw the given triangles on the graph paper and also draw their lines of symmetry.**



2. **Draw the lines of symmetry of each of the following figures:**



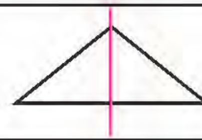
3. **Complete the shapes given in the following figures by taking the dotted lines as the axis of symmetry:**



4. **Prepare the lists of the English alphabets having and not having the lines of symmetry.**

5. **Complete the following table:**

Name of the plane figures	Figure with the line of symmetry
Isosceles triangle	

Square	
Rectangle	
Equilateral triangle	

6. **Find whether the following traffic signs are symmetric or not.**

(a) 	(b) 	(c) 	(d) 

7. **Find whether the given figure is symmetric or not. Why?**

Project work

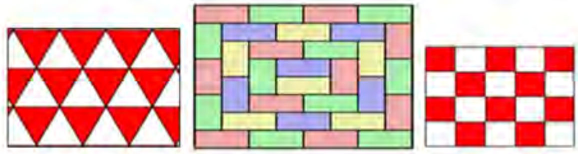
Out of the objects you have or you have seen, find out the names of 10 objects each that are symmetric and non-symmetric and present in the classroom.

Answers:

Show all the answers to your teacher.

19.2 Tessellation from rectangle and square

Observe the given figures. How many and what type of patterns are in these figures? Observe and make their lists by discussing with your friends.



In the above figures, triangles, rectangles and squares are arranged in a fixed pattern touching each other tightly with no overlapping. These are the tessellation of geometrical figures.

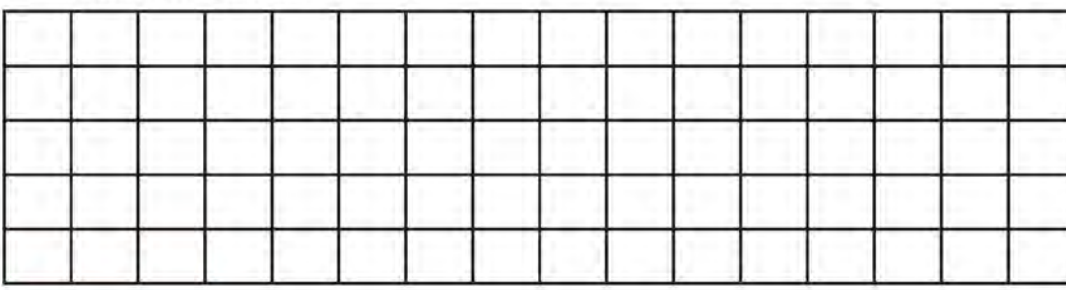
Activity 1

Observe the given figure and discuss the questions:

(a) What type of geometrical shapes have formed the figure?

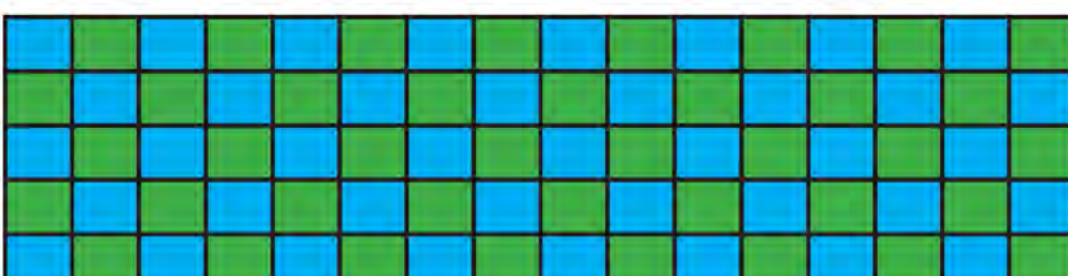
(b) What type of patterns can be seen in the figure?

(c) Present its square-shaped shapes in different ways by filling them with different colours.



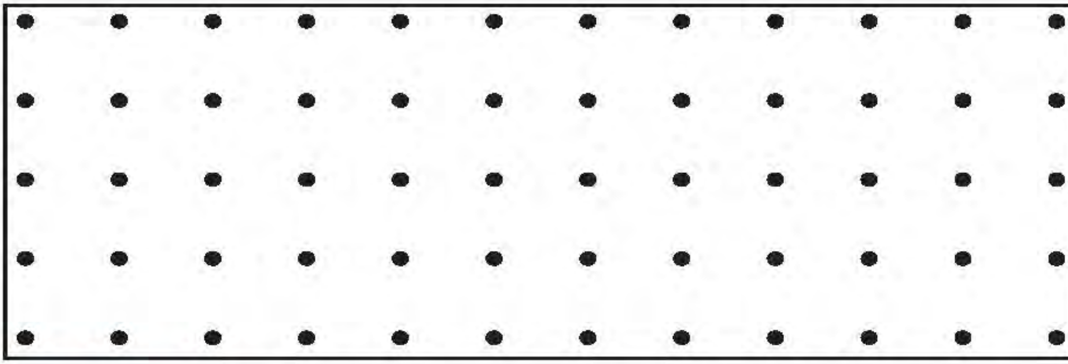
Solution:

For example, one of the ways of colouring is shown below:



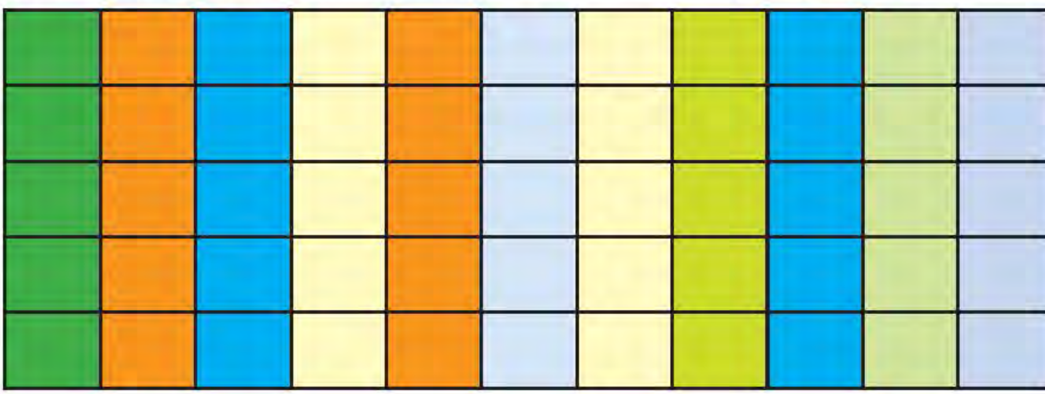
Activity 2

Make rectangular tessellation by using the dots and fill them with appropriate colour.



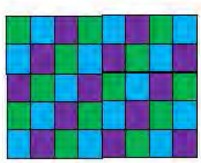
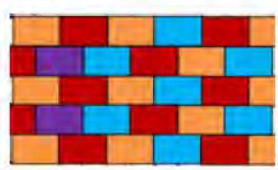
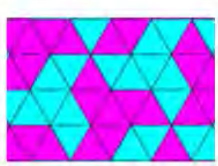
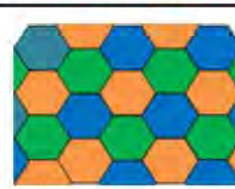
Solution:

The following rectangular tessellation can be made by using the above dots.

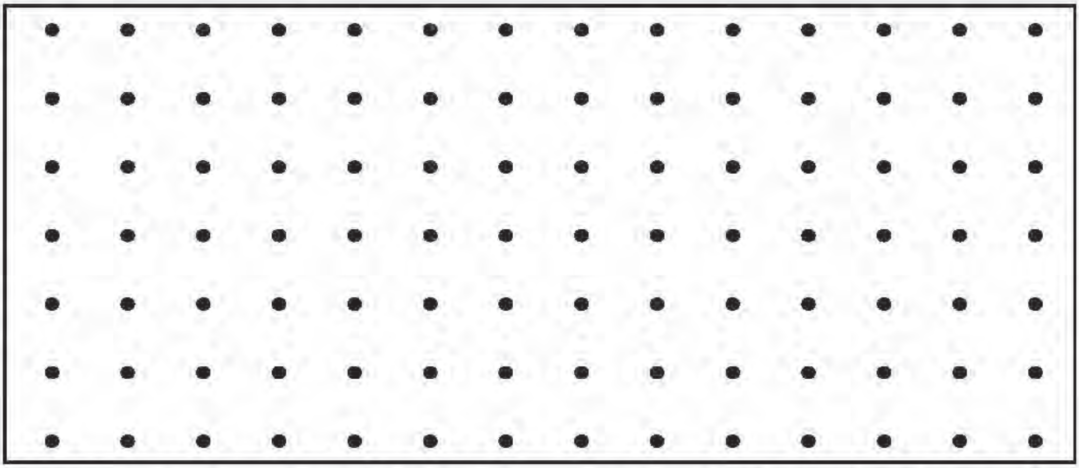


Exercise 19.2

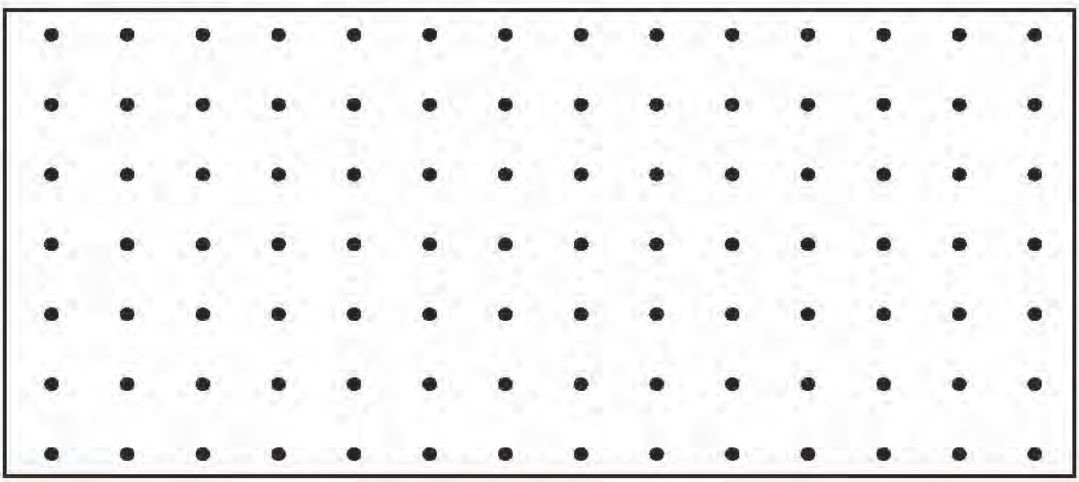
1. What and how many designs are in the following figures? Find.

(a) 	(b) 
(c) 	(d) 

2. **Make rectangular tessellations by using the following dots and fill them with appropriate colour:**



3. **Make square-shaped tessellations by using the following dots and fill them with suitable colour:**



Project work

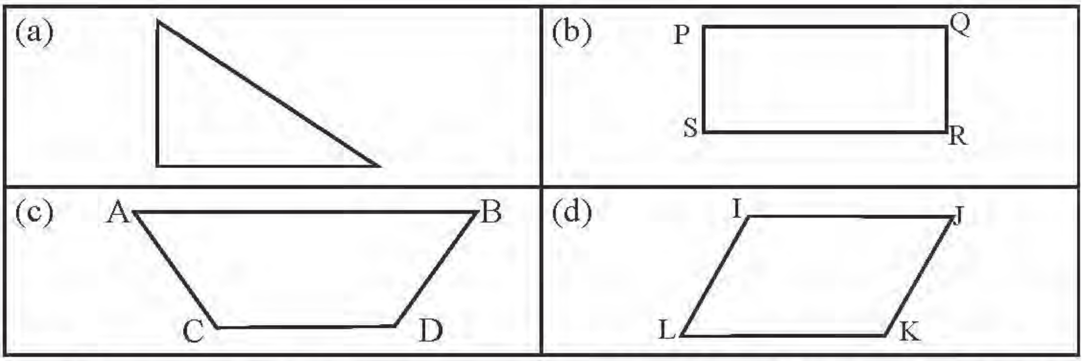
Observe the floor and the wall of your school, house and nearby religious site. Observe the designs of those places, and draw figures on your copy and fill them with colors.

Answers:

Show the answers to your teacher.

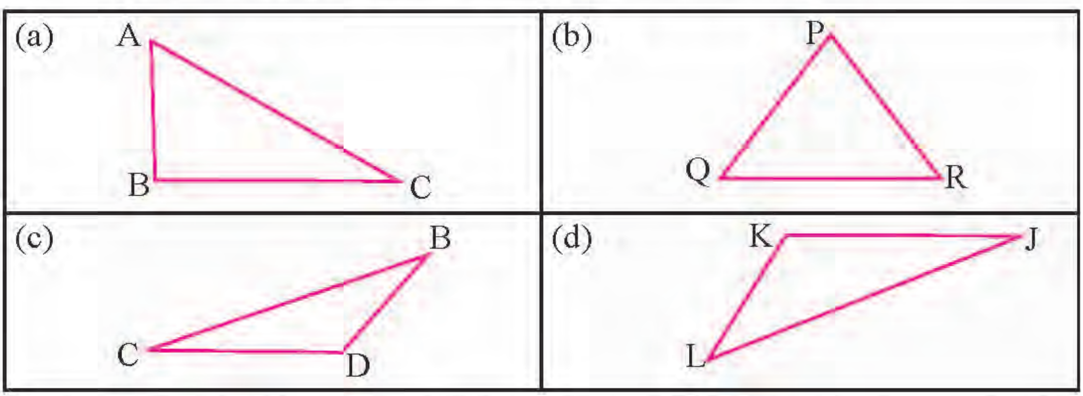
Miscellaneous Exercise

1. Identify and write the names of perpendiculars and the parallel sides in the following figures:



2. Use a protractor to measure the angles of the figures given in the above question 1. Also write the types of those angles.

3. Measure the angles and the sides of the following triangles and classify them on the basis of the angles and the sides.



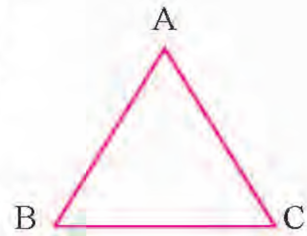
4. Draw a 5 cm long straight line segment AB. Draw its perpendicular bisector. Mark C on the perpendicular bisector at 4cm length. Join C and A and C and B. Write the type of figure formed.

5. Draw a straight line segment AB of length 6 cm. Draw a 90° angle at A towards right and 30° angle at B towards left of that line segment AB. What type of figure is formed? Write.

6. Draw a straight line segment PQ. On this line segment, draw 120° angles on the right side of P and Q. Draw a line segment RS parallel to PQ with the help of a set square. Write the type of figure is formed.

7. **Find the midpoint of the base BC of the adjoining triangle ABC. Join the midpoint of BC to vertext A. What type of triangles are the two triangles formed in this way? Find out by measuring their angles.**

8. **Draw a straight line segment AB. Draw 60° angles at A towards right and at B towards left on AB. What type of figure is formed? Measure all the sides and angles and write.**



9. **Draw a straight line segment XY = 6 cm. Draw a 90° angle at X towards right and a 60° angle at Y towards left of that line segment XY. What type of figure is formed? Write, by measuring all angles and sides.**

10. **Draw a line segment PQ = 7 cm. Draw a line segment XY parallel to PQ with the help of a set square. With the help of a protractor, draw 80°/80° angles at the points P and Q towards the same sides. Mark the points of intersection on XY by R and S. What type of figure is formed? Write by measuring all the angles and the sides.**

11. **A cuboidal tank has 6 flat faces. If its number of edges is 12, find its number of vertices.**

12. **What is the difference between the plane figure and the solid figure? Write with figures.**

13. **Plot the points (0,9), (5,9), (0,-2) and (5,-2) on a graph paper. Join these points in the order and write the name of the figure so formed.**

14. **Draw a straight line AB = 5 cm.**
    (a) Draw $\angle BAX = 90°$ and $\angle ABY = 90°$.
    (b) Take the arcs of radii 7 cm on the line AX and BY and mark them by C and D respectively.
    (c) Join the points C and D and D and A.
    (d) What type of triangle is ACD? Write by measuring all of its angles and sides.

Answers:

Show all the answers to your teacher.

Unit Six | Statistics

Lesson 20

Statistics

20.0 Review

The details of food consumed at Lalita's home in the month of Baishakh, 2076 BS is given in the following table. Study the table and answer the following questions:

S.N	Name of Food	Quantity (in kg)
1.	Potato	10
2.	Peas	3
3.	Salt	2
4.	Sugar	5
5.	Rice	40
6.	Spices	1
7.	Pulse	7
8.	Beaten Rice	6

(a) Which food item is most consumed at Lalita's home?

(b) Which food item is least consumed at her home?

(c) How much sugar is consumed at Lalita's home in a month?

(d) How many kgs of food is consumed at Lalita's home in a month?

20.1 Frequency table

Activity 1

Here are the responses by the students of grade six when they were asked about which vegetable they like most:

Stick bean	Bean	Gourd	Cauliflower	Gourd	Stick bean	Cauliflower
Cauliflower	Bean	Cauliflower	Cauliflower	Pumpkin	Gourd	Pumpkin
Bean	Pumpkin	Cauliflower	Bean	Pumpkin	Stick Bean	Pumpkin
Cabbage	Cauliflower	Bean	Gourd	cabbage	Bean	Sick bean
Cauliflower	cabbage		Gourd			

Present the above information as in the following table:

Vegetable	Tally mark	Frequency
Stick bean	||||	4
Gourd		
Cauliflower		
Bean		
Pumpkin		
Cabbage		
Total		

Now, answer the following questions on the basis of the above table:

(a) Which vegetable is liked by most students?

(b) Which vegetable is liked by fewest students?

(c) How many students like cauliflower?

(d) How many students are there in that class?

The information collected on any item or object (material or immaterial) is called data. The data collected at the beginning is called raw data. This type of data can become more informative and easier when presented the form of a frequency table with the Tally Bars. The total number of times by which an item is repeated while collecting the data is called the frequency of that item. The table in which all items of the raw data are presented together with their frequencies by using the Tally Bars is called a Frequency table.

Example 1

1. A cheesemonger has been found to have sold the milk (*ml*) to some families in the following quality:

500	700	1000	500	2000	1000
1500	1500	1000	500	500	500
1000	700	500	500	700	500
500	1000	700	1000	1500	500
700	700	2000	1000	2000	1500

Present the data in form of a frequency table together with Tally Bars and answer the following questions:

(a) How many families consume the largest amount of milk?

(b) How many families consume the least amount of milk?

(c) What is the total number of families from that locality who consume milk?

Solution:

Presenting the above data in form of a frequency table with the Tally Bars, we get,

Frequency Table

S.N.	Amount of milk(ml)	Tally Bars	Frequency
1.	500	卌 卌	10
2.	700	卌 |	6
3.	1000	||	7
4.	1500	||||	4
5.	2000	|||	3

On the basis frequency table, answers to the above questions are as below:

(a) The number of families consuming the largest amount of milk is 3.

(b) The number of families consuming the least amount of milk is 10

(c) The total number of families consuming the milk is 30.

Exercise 20.1

1. **The scores secured by 30 students of grade 6 from Shreekrishna Secondary School in mathematics examination of 20 marks are as below:**

2	14	9	6	13	7	8	11	12	9
5	4	15	19	20	17	16	13	20	19
15	9	15	12	17	13	18	19	16	15

Show the above scores in the frequency table by using the Tally Bars:

2. **The heights (in cms) of 32 students of grade 10 are as below:**

123	122	121	120	124	120	122	121	120	123	120	122
124	123	121	124	120	124	122	121	123	122	123	123
122	121	120	124	120	121	123	122				

Present this data in the frequency table by using the Tally Bars.

3. **The daily wages (in Rs.) of the workers of a shoes factory are as below:**

170	200	150	180	220	170	190	160	220	200	150	180
160	220	210	180	210	200	180	160	180	170	200	150
180	210	220	190	180	170	160	180	150	200	220	190
180	170	180	160								

Present the above data in the frequency table by using the Tally Bars.

4. **The students of grade 6 of Bhagyodaya Basic School come to the school on foot or by other means. This data is given as below:**

Bus	cycle	Cycle	Taxi	Bike	Foot	Bus
Foot	Taxi	Foot	Bus	Foot	Taxi	Foot
Foot	Cycle	Bike	Foot	Cycle	Cycle	Taxi
Taxi	Bus	Cycle	Bus	Taxi	Foot	Foot
Bus	Bike	foot	Bus	Bike	Bike	Bus
Foot	Taxi	Bus	Cycle	Foot		

Present the above information in a frequency table by using the Tally Bars and answer the following questions:

(a) In which group do the largest number of students fall?

(b) In which group do the fewest number of students fall?

(c) How many students come to school on foot?

(d) In which groups are there equal number of students and why?

(e) How many students in total are there in the class?

Project work

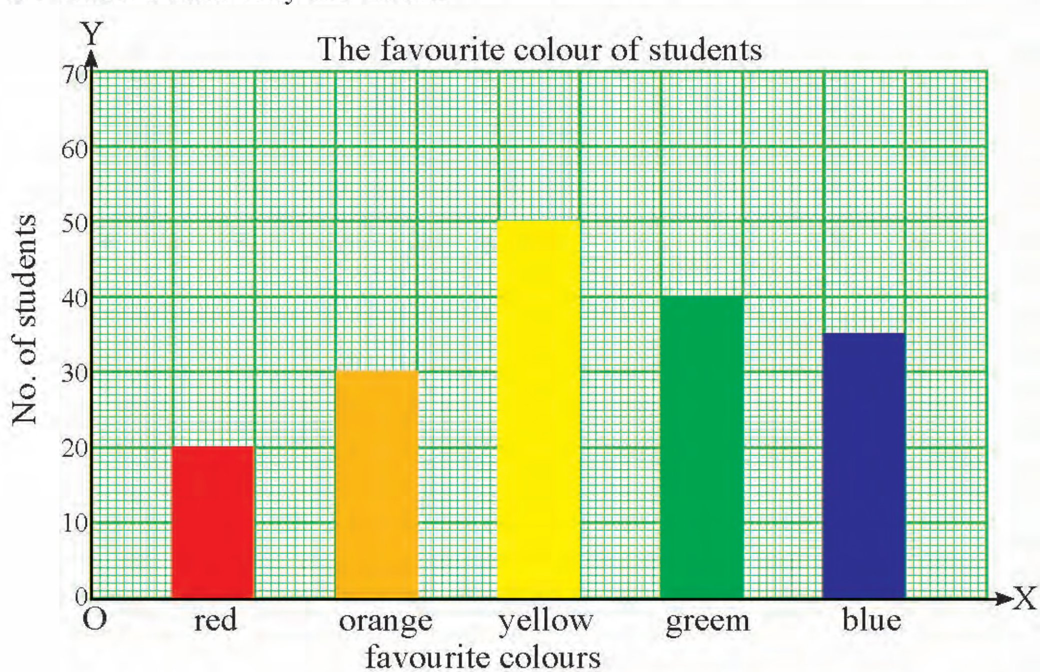
Show the marks in mathematics secured by all the students of your class in the first terminal examination in the form of a frequency table and present it in the classroom.

Answers:

Show all the answers to your teacher.

20.2 Simple bar diagram

Discuss the following questions by studying the given bar diagram prepared on the basis of the responses of the question put to the students of grade 6 about which colour they like most.



(a) Which colour is liked by most of the students?

(b) Which colour is liked by the fewest number of students?

(c) How many students like the green colour?

(d) How many students are there in total in that school?

(e) What is the name of the above figure?

A diagram made by using the rectangular bars whose heights represent the frequencies of the items of the data is called a bar diagram.

Points to remember while making the bar diagram:

1. While making the bar diagram, X-axis and Y-axis should be clearly drawn.
2. The title should be given to the bar diagram.
3. All the rectangular bars must have the same width.
4. The distance between two bars must be equal.

Example 1

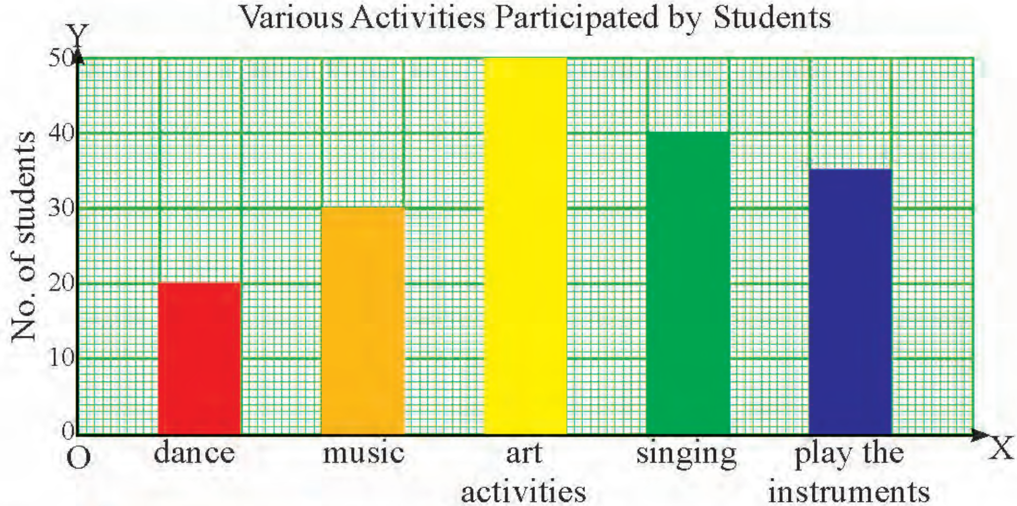
The data of various activities participated by 150 students of grade 10 of Gyanodaya Secondary School is given below. Show the data in simple bar diagram on a graph paper.

Activities	Dance	Music	Art	Singing	Play instruments
No. of Students	30	40	35	20	25

Solution:

Showing the above data in a simple bar diagram a graph, we have,

Various Activities Participated by Students



Exercise 20.2

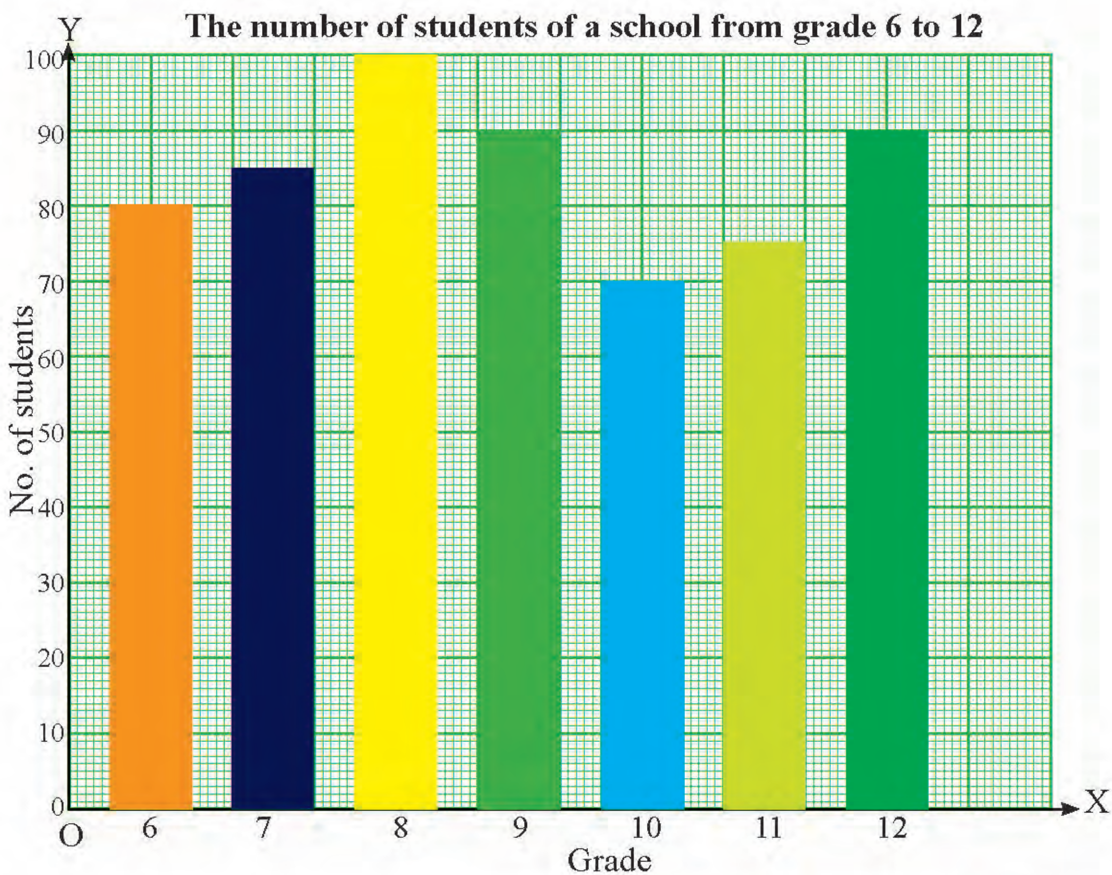
1. **Express the following data in form of a simple bar diagram:**

Days	Sunday	Monday	Tuesday	Wednsday	Thursday	Friday
Absent students	5	10	25	10	5	5

2. **The scores secured by Saurav in the first terminal examination are given in the following table. Show these scores in a simple bar diagram.**

Subject	Nepali	Maths	English	Science and Technology	Social studies and Human value education
Marks obtained	65	90	75	80	55

3. **The number of students of a school from grade 6 to 12 is given in the following simple bar diagram. Answer the following questions by observing the diagram:**



(a) In which class are there the largest number of students?

(b) In which class are there the fewest number of students?

(c) How many students are there in the grades 8 and 11 ?

(d) How many students are there in that school from grade 6 to 12 in total?

(e) Prepare the frequency table of the simple bar diagram.

4. The information of the animals in an animal firm is given below. Show the number of animals in a simple bar diagram.

Animal	cow	buffalo	sheep	goat	pig
Number of animals	15	10	35	40	25

Project work

Show the class wise number of students of your school in a simple bar diagrams. Present the diagram together with a report in the classroom.

Answers:

Show all the answers to your teacher.

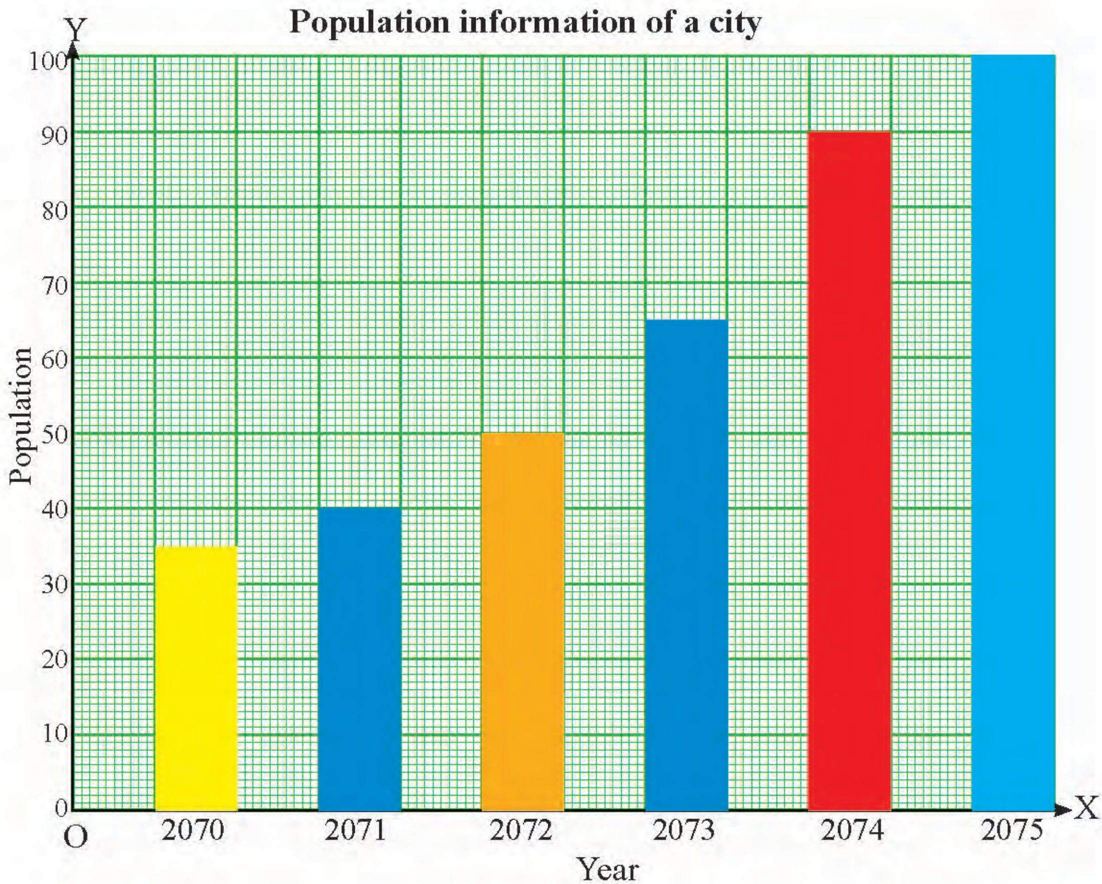
Miscellaneous exercise

1. The following data is obtained from the responses of the question put to the 39 students of grade 6 about how many family members they have:

3	3	3	3	4	4	4	4	4	4	5	5	5
5	5	5	5	6	6	6	6	6	6	6	6	7
7	7	7	7	4	5	6	7	4	5	6	3	5

Present the above data in the form of a frequency table by using the Tally Bars. Also, draw a simple bar diagram of the data.

2. **The population (in lakhs) of a city of 6 years is given in the following simple bar diagram. Observe the bar diagram and answer the following questions.**



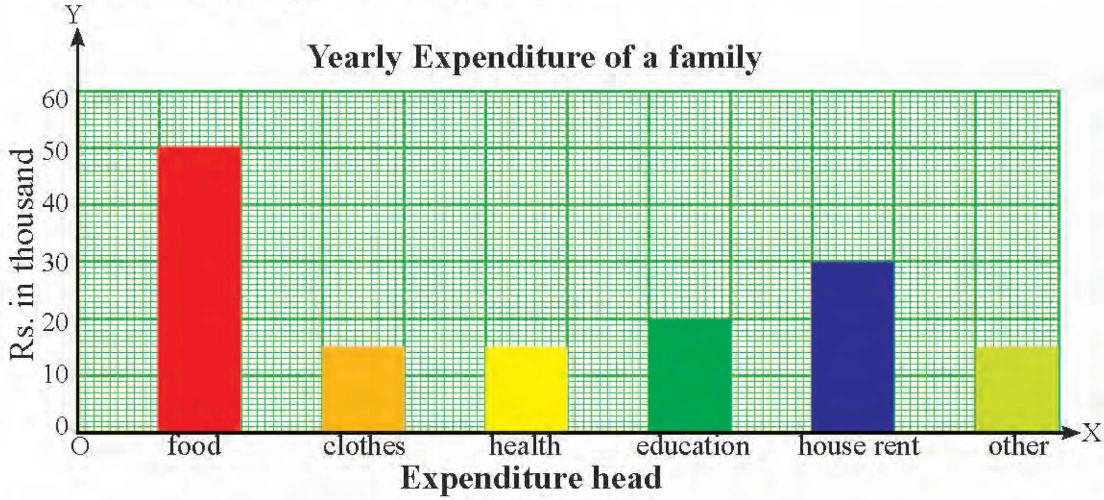
(a) In which year is there the largest population?

(b) What is the population of 2072?

(c) In which year is there the lowest increase in the population and by how much?

(d) Prepare a frequency table of the above simple bar diagram.

3. **The yearly expenditure (in Rs. thousand) of a family is given in the following simple bar diagram:**



Observe the simple bar diagram and answer the following questions:

(a) In which head is there the largest expenditure of that family?

(b) How much is the annual expenditure of the family on education?

(c) Which heads have equal expenditures and how much?

(d) What is the total annual expenditure of the family?

(e) What percent of the total expenditure of that family is on food?

(d) Prepare a frequency table on the basis of the information obtained from the above simple bar diagram.

Project work

Be divided into 5 groups. Each group should go to five different residencies around. Get the information about blood groups of 50 people. Express the data in the form of the frequency table with Tally Bars and in simple bar diagram and present in the classroom.

Answers:

1. Show the answer to your teacher.
2. (a) 2075 BS (b) 50 lakhs (c) 2071 BS and by 5 lakhs (d) Show the answer to your teacher
3. (a) Rs. 50 thousands in food (b) 20 thousands (c) Cloths, Health and others 15 thousands (d) 1 lakh 40 thousands (e) 35.71% (f) Show the answer to your teacher.